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Some Revisions of American Orchids

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This paper presents several new species and varieties as well as nomenclatural changes which are necessary for some of our American orchids. In addition, it includes a treatment of the American representatives in the genus *Calanthe* and a revision of the genera *Arpophyllum* and *Govenia*.

I. NOVELTIES AND NOMENCLATURAL CHANGES

Spiranthes acaulis (J. E. Sm.) Cogn. var. **assurgens** (Reichb. f.) Correll comb. nov.

Spiranthes assurgens Reichb. f. in Beitr. Orch. Centr.-Am. 66. 1866.
Spiranthes picta (Anders.) Lindl. var. *assurgens* (Reichb. f.) Ames & Correll in Bot. Mus. Leafl. Harvard Univ. **10**: 67. 1942.

The subsequent transfer of *Spiranthes picta* to *S. acaulis* necessitates the above new combination.

The only distinctive difference separating the var. *assurgens* from the typical form is the shape of the lip which is broad at the base and gradually narrowed above to the apical lobule. The lower portion below the constriction is thus lanceolate instead of being oblanceolate as in typical *S. acaulis*.

Terrestrial. Found only in Guatemala.

Spiranthes trilineata Lindl. var. **thelymitra** (Reichb. f.) L. O. Wms. comb. nov., ined.

Spiranthes thelymitra Reichb. f. in Beitr. Orch. Centr.-Am. 66. 1866.
Gyrostachys thelymitra (Reichb. f.) O. Ktze., Rev. Gen. Pl. **2**: 664. 1891.
Deiregyne thelymitra (Reichb. f.) Schltr. in Beih. Bot. Centralbl. **37**, Abt. 2: 428. 1920.
Sarcoglottis thelymitra (Reichb. f.) Ames in Bot. Mus. Leafl. Harvard Univ. **2**: 76, 84. 1934.

The var. *thelymitra* differs from the typical form mainly in that the lip, instead of being essentially entire, is conspicuously constricted near the apex to form a suborbicular lobule which is fleshy and covered with minute papillae, with the margins somewhat undulate.

In grasslands and in mixed oak-pine forests, up to 2500 m. alt. Rather widespread, in Mexico, Guatemala, Salvador, Honduras and Costa Rica.

Erythrodes querceticola (Lindl.) Ames var. **venustula** (Ames) Correll comb. nov.

Physurus venustulus Ames, Orch. **2**: 261. 1908.
Erythrodes venustula (Ames) Ames, Orch. **5**: 28. 1915.

Variety *venustula* is best distinguished from the typical form of the species by its long floral bracts which are foliaceous, being 6–20 mm. long and mostly exceeding the flowers at anthesis. It is epiphytic, whereas typical *E. querceticola* is apparently entirely terrestrial. This latter distinction, however, is arbitrary because terrestrial and epiphytic plants are often found in the same species.

Epiphytic. Rare in Guatemala and Costa Rica.

Pleurothallis pansamalae Schltr. var. **triangulabia** Correll var. nov.

Haec varietas foliis saepissime latioribus atque labello triangulari vel triangulari-ovato cum parte basali utrinque plusminusve lobulato a specie differt.

Variety *triangulabia* is similar to the typical form except for the usually broader leaves and the shape of the lip. Instead of being ovate and rounded on each side at the base, the lip is triangular or triangular-ovate with a lobule on each side at the base or with each side slightly dilated and truncate.

Epiphytic on trees in dense forests, up to 2600 m. alt.

MEXICO: Chiapas, *E. Matuda 2395*.

GUATEMALA: Volcán Zunil, epiphytic on tree trunk in heavy forest, flowers greenish, 7900 ft. alt., August 4, 1934, *A. F. Skutch 942A* (*Type* in Herb. Ames No. 58242). Quezaltenango, *A. F. Skutch 1424*. Suchitepéquez, *J. A. Steyermark 46697*.

Malaxis Steyermarkii Correll sp. nov.

Herba parvula, glabra, erecto-adscendens, vagina tubulari basi atque folio unico prope caulis medium ornata. Folium cordato-ovatum, abrupte subacutum, basi caulem amplectens. Racemus brevis, subumbellatus. Florum bracteae minutae, triangulari-ovatae, acutae. Flores minuti, virides, cum ovario pedicellato filiformi. Sepala late patentia cum marginibus conspicue revolutis, elliptico-oblonga vel anguste ovato-elliptica, obtusa. Petala valde recurva, linearia, acuta. Labellum in circuitu subquadratum, basi utrinque auriculatum, apice inaequaliter trilobatum, concavum; lobi laterales magni, oblique triangulari-lanceolati, acuti vel acuminati, prominenter divaricati; lobus medius minutus, apiculatus. Columna generis, carnosus.

Plant small, glabrous, erect-ascending, 7 cm. tall, provided at the base with a tubular obtuse shealth and at about the middle of the stem with a solitary leaf; sheath 1.5 cm. long. Leaf cordate-ovate, abruptly subacute, clasping the stem at the base, silvery green beneath, 3 cm. long, 2.7 cm. wide. Raceme short, subumbellate, 1.5 cm. or more long. Floral bracts

minute, triangular-ovate, acute, about 1 mm. long. Flowers minute, green, with filiform pedicellate ovaries which are 7.5 mm. long. Sepals spreading, with conspicuously revolute margins, 1-nerved, elliptic-oblong to narrowly ovate-elliptic, obtuse, 2 mm. long, 0.8 mm. wide. Petals strongly recurved, linear, acute, 1-nerved, 1.8 mm. long, 0.3 mm. wide. Lip subquadrate, auriculate at the base, unequally 3-lobed at the apex, concave, about 3 mm. long including the apical lobes, 1.5 mm. wide; lateral lobes large, obliquely triangular-lanceolate, acute or acuminate, conspicuously divaricate, about 1.5 mm. long; mid-lobe minute, apiculate. Column small, fleshy, about 0.5 mm. long.

The cordate-ovate leaf and uniquely bicornute lip with the lateral lobes strongly divaricate are distinctive.

It is a pleasure to associate with this unusual species of *Malaxis* the name of Julian Alfred Steyermark who, through his extensive collecting, has added greatly to our knowledge of the flora of Guatemala.

GUATEMALA: Huehuetenango, Cerro Negro, 2 miles east of Las Palmas, Sierra de los Cuchumatanes, alt. 1600–2000 m., Liquidambar-forested slopes along moist ravine, August 31, 1942, *J. A. Steyermark 51672* (Type in Herb. Chicago Natural History Museum No. 1126516).

Epidendrum tampense Lindl. var. **Amesianum** Correll var. nov.

Haec varietas foliis saepissime minoribus et labello omnino roseopurpureo (non luteo-fusco cum macula purpurea) et labelli disco laeviori (non dense papilloso) a specie differt.

In April 1932, Professor Oakes Ames first observed this plant growing under cultivation in the Botanic Garden of the Atkins Institution of the Arnold Arboretum in Cuba. The specimens had been discovered by John G. Jack near San Blas in the Province of Santa Clara. At the time Ames was of the opinion that this plant was somewhat different from the Floridian *E. tampense* which it closely resembled, but he decided to await further material before publishing his opinion.

In 1941, Richard A. Howard greatly supplemented the available material when he obtained a large collection from the province of Oriente, Cuba.

After critically comparing the Cuban specimens with a large series of the Floridian *E. tampense*, I am of the opinion that they are closely allied and should be maintained as only varietally distinct. The var. *Amesianum* differs primarily from typical *E. tampense* in the characteristically smaller (one to three) leaves which are usually less than 8 (rarely as much as 15) cm. in length, the self-colored deep rose-purple instead of yellowish brown lip with purple markings, and the essentially smooth, not densely papillose, disc of the lip.

It gives me great pleasure to associate with this variety the name of Professor Oakes Ames, who first pointed out its differences from the Floridian plant.

CUBA: Santa Clara Province, near San Blas, epiphyte along mountain trail, 700–1000 ft., April 1932. Flowering under cultivation. *Prof. John G. Jack* (*Type* in Herb. Ames No. 37885); *John G. Jack 7289, 7589*. Oriente Province, San José, Sierra de Nipé, common orchid on serpentine ground, perianth pink, outer parts darker, July 1941, *R. A. Howard 6156*.

Scaphyglottis cuneata Schltr. var. **major** (C. Schweinf.) C. Schweinf. comb. nov., ined.

Scaphyglottis Wercklei Schltr. var. *major* C. Schweinf. in Bot. Mus. Leafl. Harvard Univ. **4**: 117. 1937.

The subsequent transfer of *Scaphyglottis Wercklei* to *S. cuneata* necessitates the above new combination.

The var. *major* differs from typical *S. cuneata* in being a stouter plant with the lower stem-members much longer (up to 17 cm. long), and with longer leaves (5.5–12 cm. long).

Epiphytic on tree trunks in forests at low elevations. Found in British Honduras and Guatemala.

Maxillaria pulchra (Schltr.) L. O. Wms. comb. nov., ined.

Camaridium pulchrum Schltr. in Fedde, Repert. **10**: 251. 1911.

This species is closely allied to *M. Camaridii* Reichb. f.

Epiphytic on trees in forests, usually at low elevations, up to 1600 m. alt. Found in Mexico, British Honduras, Guatemala and Honduras.

Maxillaria Nagelii L. O. Wms. nom. nov., ined.

Camaridium Tuerckheimii Schltr. in Fedde, Repert. **10**: 296. 1912, *non Maxillaria Tuerckheimii* Schltr., 1912.

The specific epithet is in honor of Mr. Otto Nagel, who has made numerous excellent collections of Mexican orchids.

Epiphytic on trees in humid cloud forests, up to 1800 m. alt. Very rare in Mexico and Guatemala.

Odontoglossum stenoglossum (Schltr.) L. O. Wms. comb. nov., ined.

Miltonia stenoglossa Schltr. in Fedde, Repert. Beih. **19**: 66. 1923.

This species is closely allied to *O. laeve* Lindl.

Epiphytic on trees in wet or dry forests or on rocks, up to 1600 m. alt. Uncommon in Mexico, Guatemala, Honduras and Costa Rica.

Oncidium oliganthum (Reichb. f.) L. O. Wms. comb. nov., ined.

Odontoglossum oliganthum Reichb. f. in Bonpl. **4**: 321. 1856.
Oncidium guatemalense Schltr. in Fedde, Repert. **10**: 362. 1912.
Odontoglossum Purpusii Schltr. in Fedde, Repert. **21**: 340. 1925.

Epiphytic on trees in forests, up to 2000 m. alt. Rare in Mexico and Guatemala.

II. The Genus Calanthe in America

The genus *Calanthe*, consisting of about one hundred forty species which are widely distributed in the Old World tropics, is represented in tropical America by the following single species and its two new varieties.

Calanthe mexicana Reichb. f. in Linnaea 18: 406. 1844.

Ghiesbreghtia calanthoides A. Rich. & Gal. in Ann. Sci. Nat. sér 3, **3**: 28. 1845.
Ghiesbreghtia mexicana "A. Rich. & Gal." ex Reichb. f., Xen. Orch. **1**: 205. 1856, in synon.

Plant coarse, from a short thick rhizome, up to 7 dm. or more tall when in flower. Stem abbreviated. Leaves two, basal, opposite, narrowly elliptic to broadly elliptic, abruptly acute, plicate, tapering to the broad petioles which clasp the peduncle, 2–6 dm. long including the petiole, 4–15 cm. wide, subtended by two or more membranaceous fibrous appressed sheaths. Peduncle erect, slender, 3–7 dm. long, glabrous below, hispidulous above, naked except for a solitary linear-lanceolate bract. Raceme laxly many-flowered, 6–13 cm. long, usually densely hispidulous. Floral bracts linear-lanceolate, long-acuminate, 1–3 cm. long, about 3 mm. wide near the base. Flowers white or pink, marked with yellow and reddish brown, more or less hispidulous throughout, on slender pedicels which are 4–8 mm. long, with the perianth segments prominently nervose. Sepals ovate-elliptic to elliptic, spreading-recurved and tapering to the acute apex, 8–15 mm. long, 5–7 mm. wide below the middle; lateral sepals oblique. Petals obovate to cuneate or oblanceolate, rarely linear-elliptic, rounded to broadly acute at the apex, oblique, 7–10 mm. long, 2.5–4 mm. wide near the apex. Lip adnate to the column, variable, fleshy, hairy, more or less conduplicate and recurved in natural position, when spread out obovate-cuneate to elliptic or rarely subquadrate, subtruncate to subacute at the apex, sometimes with a small apicule and thickened along the center, produced at the base to form a spur, 4–9 mm. long, 3.5–6 mm. wide above the middle; spur conical, acute, 4–6 mm. long. Column short, thick, with a projecting angle on each side at the apex, 4–5 mm. long. Capsule ellipsoid, pendent, about 3 cm. long.

The flowers of this species are variable in the shape of the lip. In Guatemala, this plant is commonly called "tarsote."

Terrestrial in leaf mold of dense wet forests and barrancas, from 80 to 3500 m. alt.

Mexico: Chiapas, *Ghiesbreght 89, 769; E. W. Nelson 3209; O. Nagel & E. Monzón 6624.* Oaxaca, *C. Conzatti 961.* Vera Cruz, *Botteri 3; O. Nagel & Juan G. 4215.*

Guatemala: Alta Verapaz, H. von Türkheim II 1338; *H. Johnson 605.*

Costa Rica: Tablazo, *A. C. Brade 1007.* Irazu, La Cañada, *C. H. Lankester 1068a.* San José, near Quebradillas, *P. C. Standley 43067.* From Vara Blanca to La Concordia, *W. R. Maxon & A. D. Harvey 8449.* Bought in Cartago market from a Tabosi woman, *C. H. Lankester 506.*

Panama: Chiriquí, *P. H. Allen & R. J. Seibert 825; R. E. Woodson, Jr. & R. W. Schery 303; R. E. Woodson, Jr., P. H. Allen & R. J. Seibert 825.* Boquette, *Ruth D. Svihla.*

Calanthe mexicana Reichb. f. var. **lanceolata** Correll var. nov.

Haec varietas sepalis lateralibus elliptico-lanceolatis acuminatis et labello obovato vel flabellato vel subquadrato vel elliptico conspicue apiculato a specie differt.

Variety *lanceolata* differs from the typical form primarily in that the lateral sepals are characteristically elliptic-lanceolate and acuminate, and the lip is obovate to flabellate or subquadrate (rarely elliptic) in outline and is prominently apiculate. The rather large flowers are usually not so hispidulous as in typical *C. mexicana*. The floral bracts occasionally reach 6 cm. in length.

This variety is apparently confined to several islands in the West Indies. It occurs as a terrestrial in dense moist woods or thickets in humus or on wet rocks, up to 1700 m. alt.

JAMAICA: Marce's Gap, *N. L. Britton 101; G. E. Nichols 17*. New Haven Gap, *W. R. Maxon & E. P. Killip 940*.

HAITI: vicinity of Mission, *E. C. Leonard 3879* (atypical). Savane Zombis, *G. H. Pride 7*. Pétionville, *E. L. Ekman H 1127*.

DOMINICAN REPUBLIC: Barahona, *P. Fuertes 1374*. La Vega, in humus of woods, Constanza, flowers white-veined, lip yellow, 1200 meters alt., July 1910, *H. von Türkheim 3484* (*Type* in Herb Ames No. 31004). San Juan, *R. A. & E. S. Howard* 9057.

Calanthe mexicana Reichb. f. var. **retusa** Correll var. nov.

Haec varietas labello obcordato-cuneato, profunde retuso praesertim a specie differt. Sepala saepissime elliptica, apice rotundata et apiculata vel abrupte acuta.

Variety *retusa* differs from the typical form primarily in that the densely hispidulous lip is obcordate-cuneate, deeply retuse and usually has a thickened keel extending through the center. The sepals are characteristically elliptic and are rounded and apiculate or abruptly acute at the apex instead of tapering to an acute or acuminate apex. The flowers are usually small, and the leaves not so large as those of the typical form.

This variety is found only in Mexico. It occurs as a terrestrial in dense rich moist forests, up to 2200 m. alt.

MEXICO: Hidalgo, *C. G. Pringle 11913*. Oaxaca, *O. Nagel 3776; R. E. Schultes & Blas Pablo Reko 390*. Puebla, *Juan G. 2404*. Vera Cruz, *Botteri 886;* region of Naolinco, in humid forest in leaf mold, flowers white, lip greenish yellow with pinkish hue, 1500 meters alt., July 19, 1935, *O. Nagel & Juan G. 4731* (*Type* in Herb. Ames No. 52580).

III. REVISION OF THE GENUS ARPOPHYLLUM

ARPOPHYLLUM La Llave & Lexarza, Nov. Veg. Descr. 2, Orch. Opusc. 19. 1825; Lindl., Gen. & Sp. Orch. Pl. 151. 1832; Benth. & Hook. f., Gen. Pl. 3: 492. 1883.

Arophyllum Endl., Gen. Pl. 193, No. 1376. 1837, *sphalm.*

Epiphytic or terrestrial plants from a stout simple or branched rhizome.

Stem indurated or somewhat pseudobulbous, more or less concealed by scarious sheaths, unifoliate at the apex. Leaves fleshy-coriaceous, articulate. Inflorescence a terminal, showy spicate raceme of numerous small flowers, subtended by a large spathaceous sheath. Sepals about equal, spreading, the lateral sepals mostly gibbous at the base, adnate to the column. Petals smaller than the sepals. Lip uppermost, usually longer than the petals and sepals, conspicuously gibbous or saccate at the base, the anterior portion being elliptic-obovate, somewhat flabellate or obovate-subquadrate. Column erect, somewhat arcuate, wingless; column-foot short, nearly obsolete; pollinia eight, waxy, pyriform. Capsule ellipsoid-cylindric.

This genus consists of only two species which are confined to tropical and subtropical America. However, a number of segregates have been proposed.

Lip more than 8 mm. long ..... *A. alpinum*
Lip less than 8 mm. long ..... *A. spicatum*

ARPOPHYLLUM ALPINUM Lindl. in Benth., Pl. Hartweg. 93. 1842.

Arpophyllum medium Reichb. f., Beitr. Orch. Centr.-Am. 89. 1866.

Plant rather stout, erect-ascending, often dwarf at high altitudes. Stems arising at intervals from a stout creeping rhizome, unifoliate, somewhat compressed, 4.5–33 cm. long, up to 1cm. in diameter, nearly concealed by several large imbricated spathaceous sheaths which are more or less verrucose. Leaf at the apex of the stem, linear-ligulate, acute or subobtuse, coriaceous, usually exceeding the inflorescence, 1–5 dm. long, 1.4–3 cm. wide. Peduncle 5–13 cm. long, provided with several scarious scalelike bracts, nearly concealed by a long spathaceous sheath 3–11 cm. long. Raceme cylindrical, densely many-flowered, conspicuous, 3–14 cm. long, 2–4 cm. in diameter. Rachis and pedicellate ovaries covered with a black scurfiness. Floral bracts minute, triangular, acute, about 3 mm. long. Flowers purplish pink, with dark brown-purple stout pedicellate ovaries which are 6–12 mm. long. Dorsal sepal oblong-elliptic to elliptic-obovate, rounded to obtuse at the apex, 7–11 mm. long, 3.2–3.8 mm. wide. Lateral sepals oblong-elliptic, rounded to subobtuse at the apex, oblique, somewhat gibbous at the base and conforming with the saccate base of the lip, 8.5–11 mm. long, 3.5–5 mm. wide. Petals linear to linear-oblanceolate, rounded to subobtuse at the apex, minutely erose-crenulate along the upper margins, slightly oblique. Lip uppermost in the flower, gibbous at the base, somewhat arcuate just above the base, 9–15 mm. long; lamina elliptic-obovate to obovate-subquadrate, rounded and occasionally retuse at the apex, the incurved erose margins undulate-crisped and wavy, 4.5–7 mm. wide when spread out. Column almost terete, stout, slightly dilated above, 3.5–5 mm. long. Capsule obliquely ellipsoid-cylindric, about 1 cm. long.

A photograph of the type of *A. alpinum* shows a plant with short inflorescences which are only 4.5 cm. long and about 3 cm. in diameter. A photograph of a drawing of the flower shows the large dilated lip protruding beyond the other floral segments. The type, from Mexico, grew at 10,000 feet altitude; hence its specific epithet.

An examination of a photograph of a specimen of *A. medium* in Herb. Reichenbach shows two plants whose racemes are 9 cm. long and 2.8 cm. in diameter. This is the plant which is most common in Guatemala and which is here considered to be referable to *A. alpinum*. An examination of analytical drawings of *A. medium* from Herb. Reichenbach substantiates the above conclusions. The inflorescence of this plant is more elongated than usual.

Epiphytic on trees or terrestrial, usually in cloud forests, up to 3200 m. alt. This species is rare in Mexico and Honduras, but is rather frequent in Guatemala.

MEXICO: Chiapas, *E. Matuda 367; O. Nagel & E. Monzón 6571; E. W. Nelson 3208.* Puebla, *Juan G. 3065.*

GUATEMALA: Alta Verapaz, *H. von Türkheim 1140, II 1632; P. C. Standley 92186.* Amatitlan, *J. R. Johnston 1385; John Porter 61.* Chimaltenango, *A. F. Skutch 144.* Chiquimula, *J. A. Steyermark 31028.* Guatemala, *Margaret Ward Lewis 118; J. R. Johnston 1859; P. C. Standley 58508.* Huehuetenango, *J. A. Steyermark 49944.* Jalapa, *J. A. Steyermark 32369; Heyde & Lux 6385.* Quezaltenango, *P. C. Standley 84946.* San Marcos, *P. C. Standley 86497.* Sololá, *P. C. Standley 62357.* Totonicapan, *Margaret Ward Lewis 215; J. R. Johnston 1327.* Zacapa, *J. A. Steyermark 42637, 43254.*

HONDURAS: Tegucigalpa, *J. B. Edwards 103, 112.*

ARPOPHYLLUM SPICATUM La Llave & Lex., Nov. Veg. Descr. 2, Orch. Opusc. 20. 1825.

Arpophyllum giganteum Hartweg ex Lindl. in Ann. & Mag. Nat. Hist. **4**: 384. 1840.
Arpophyllum cardinale Linden & Reichb. f. in Bonpl. **2**: 282. 1854 (as *A. cardinalis*).
?*Arpophyllum squarrosum* Hort Donat ex Lubbers, Cat. Pl. Rar. San Donato 15. 1880.
Arpophyllum jamaicense Schltr. in Fedde, Repert. **16**: 443. 1920.
Arpophyllum stenostachyum Schltr. in Fedde. Repert. Beih. **19**: 32. 1923.

Plant up to 7.5 dm. tall, ascending from a creeping rhizome which is about 8 mm. in diameter and covered with sheaths. Stem compressed, composed of several joints, nearly concealed by long tubular sheaths which are up to 16 cm. long. Leaf solitary, ligulate, obtuse, keeled below, flat above, fleshy-coriaceous, sometimes conduplicate-ensiform, up to 5 dm. long and 4 cm. wide. Peduncle nearly concealed by a compressed spathaceous sheath which is up to 15 cm. long and 2 cm. wide. Raceme spicate-cylindric, densely many-flowered, up to 22 cm. long, 1.7–3 (usually about 2.5) cm. in diameter; rachis and pedicellate ovaries sparsely covered with black hispid glands. Floral bracts triangular, acute, about 1.5 mm. long. Flowers purplish pink, with stout pedicellate ovaries which are 4–8 mm. long. Dorsal sepal 3-nerved, oblong to elliptic-obovate, broadly obtuse to

apiculate at the apex, 4.8–5.5 mm. long, 1.5–2.8 mm. wide above the middle. Lateral sepals 3-nerved, elliptic-oblong, subacute to broadly rounded at the apex, oblique, saccate at the base and conforming with the base of the lip, 5–6 mm. long, 2–3 mm. wide. Petals narrowly elliptic to linear-oblanceolate, rounded to obtuse and with the margins erose at the apex, 1-nerved, 5–5.5 mm. long, 1.5–1.8 mm. wide. Lip 7-nerved, 5.5–6 mm. long, saccate at the base, constricted just in front of the sac, then expanded into an obovate lamina which forms a hood over the column; lamina broadly rounded and erose at the apex, about 3.5 mm. wide when spread out. Column 3.5–4 mm. long, arcuate. Capsule ellipsoid, 7–8 mm. long.

This species and *A. alpinum* are closely allied and are separable primarily on the size of the flower. In addition, however, *A. alpinum* is usually confined to higher elevations and generally has a shorter peduncle and a shorter and wider inflorescence than *A. spicatum*.

Arpophyllum giganteum was described as a plant 3 feet tall with a spike of pale lilac flowers 15–17.5 cm. long. It is referable to *A. spicatum*, the rather frequent species occurring in Mexico.

In describing *A. cardinale*, Linden and Reichenbach stated that it was "related to *A. giganteum*." Its rose-colored flowers are in an elongated-cylindric raceme. An examination of copies of two sheets of drawings from the Reichenbach Herbarium shows plants and floral diagnosis of *A. cardinale* which are typical of *A. spicatum*.

In describing *A. jamaicense*, Schlechter gave *A. giganteum* (in Fawcett & Rendle, Fl. of Jamaica, Vol. 1) as a synonym. The raceme was described as 12–15 cm. long and 2 cm. in diameter. The sepals were 5 mm. long, oblong, obtuse, and the petals subequal to the sepals. The lip was described as little longer than the sepals. This places this concept in *A. spicatum*, the lip being little more than 5 mm. long.

The inflorescence of *A. stenostachyum* was described as densely many-flowered, cylindrical, about 12 cm. long and 2 cm. in diameter; sepals 6 mm. long; petals 5 mm. long; and lip 6.5 mm. long and 4 mm. wide at the apex. An examination of flowers from the type together with a photograph of the type reveals that *A. stenostachyum* is referable to *A. spicatum*.

On trees and rocks in open mountain forests or in dense humid forests, usually at less than 1500 m. alt., rarely up to 2400 m. alt. Widespread and rather frequent in Mexico, rare in Guatemala, Honduras and Costa Rica.

MEXICO: Chiapas, *O. Nagel 4408, 5611*. Guerrero, *O. Nagel 3194, 3114; O. Nagel & Juan G. 1664; Vincente Lira 6946; Ethel A. Wragg 3100*. Mexico, *G. B. Hinton 8445; O. Nagel 4935*. Oaxaca, *Reko 2330*. Vera Cruz, *Matsumato 2116*. Vera Cruz and Oaxaca border, *Halmes 2692*.

GUATEMALA: Suchitepéquez, *A. F. Skutch 1563*.

HONDURAS: Comayagua, *J. B. Edwards 358*.

COSTA RICA: Cartago, *P. C. Standley 36009, 39719*. La Fuente, *A. Alfaro 53*. Navarro and Cachi, *C. H. Lankester 427, 1139*.

IV. Revision of the Genus Govenia

In 1845, Lindley wrote: "Among the genera of Orchis there is not one whose species are so difficult to distinguish as those of Govenia; a most natural group, with most of its members extremely similar in habit. In a dried state they are so much alike, or they vary so much in the appearance of their flowers, in consequence of the manner in which they shrink, that it is hardly possible to recognize them." (Lindley, in Bot. Reg. 31: t. 67. 1845).

In the above paragraph, Lindley gives quite adequately the difficulty involved in studying and working with this genus. He might have added that the various color forms occurring in *Govenia*, comparable in this characteristic to the genus *Stanhopea*, have resulted in a large number of proposed species. The plasticity of the thin membranaceous lip in dried material which, when boiled up for dissection, gives rise to folds, overlapping, pleating, and undulations has also resulted in several dubious concepts.

It would seem that in the past most unsatisfactory characters have been used upon which to base some of the proposed species. It is true that the flowers of plants within the genus, even of plants which apparently represent the same species, are often affected by various pigmentations and color-markings. However, while these color forms within the same species are of interest and may be segregated for horticultural purposes, they are not worthy of specific rank in a scientific treatment of the genus.

The floral segments of all the species are arcuate in natural position and conform with the arcuate column. The characteristic shape of the lip of most of the plants is broadly ovate or ovate-elliptic. There are minor variations, however, and in several cases differences exist which are sufficient to segregate a species and a variety, for example *G. mutica* and its var. *Purpusii*.

Numerous flowers, of both dried and preserved fresh material, have been examined, and, so far as I am able to determine, the lip of all species of *Govenia* is plane and always lacks keels or calli of any kind. In fact, the only adornment (other than color) consists of small round dark-colored glands or excresences near the apex of the lip. Occasionally ciliations or pubescence occur. The lip is always arcuate with the lateral margins more or less upcurved and forming a longitudinal channel. Thus, when the lip is flattened a surplus amount of tissue results and a slack is created. The excess tissue often forms two or more longitudinal ridges on the disc or a transverse fold on each side at about the center. In some cases, both of the above conditions occur simultaneously; or again the surplus tissue may be forced toward the base of the lip to create a cordate appearance. It seems to me that manipulation of the lip, either accidentally or unwittingly, has been rather

carelessly used to describe untenable concepts, and has thus been a misleading factor for subsequent botanists.

Govenia consists primarily of two rather frequent species, these being *G. utriculata* and *G. superba*. What is here recognized as *G. utriculata* characteristically has white or light cream-colored (sometimes light lavender) flowers, while *G. superba* characteristically has yellowish or orange flowers. The similarlity of the flowers of these two species is striking. However, those of typical *G. utriculata* are usually (but not always) fewer and larger than those of typical *G. superba*.

In the present paper only five species and three varieties of *Govenia* are recognized as valid out of twenty-six species that have been proposed for the genus. This pruning may be too severe in view of the absence of some types or records of types, several of which are not extant. However, the present treatment is simply a revision and is offered more for convenience in dealing tentatively with the plants comprising the genus rather than as a final monographic treatment of the genus. Hence, it is susceptible of changes when circumstances enable us to obtain additional types and records of types for several of the more questionable concepts. Despite this consideration, I do not believe that from an herbarium standpoint the present treatment will be greatly affected by further examination of types for, as Lindley stated more than a hundred years ago, it is well-nigh impossible to recognize the plants in the dried state.

GOVENIA Lindl. ex Lodd., Bot. Cab. **18**: t. 1709. 1831; Lindl., Gen. & Sp. Orch. Pl. 153. 1832; Benth. & Hook. f., Gen. Pl. **3**: 542. 1883.

Eucnemis Lindl., Gen. & Sp. Orch. Pl. 161. 1833.
Eucnemia Reichb. f., Nom. Bot. 53. 1841.

Terrestrial herbs having the rhizome sometimes thickened into tuber-like pseudobulbs and above with one or two leaves which are clothed at the base by several elongated (sometimes conspicuously inflated) sheaths. Leaves ample, plicate, with many veins, articulate with the leaf-sheaths. Peduncle slender or stout, simple, provided with one or more clasping sheathing bracts. Inflorescence a terminal few- to many-flowered raceme. Floral bracts narrow, rarely exceeding the pedicellate ovary. Flowers variously colored, congested or distant. Dorsal sepal incurved, longer and narrower than the lateral sepals, usually fornicate. Lateral sepals falcate or decurved, at the base forming a short chin with foot of the column. Petals similar to the lateral sepals. Lip articulate to the foot of the column, arcuate and longitudinally concave in natural position, conforming with the column, simple and ecallose, usually shorter than the sepals and petals. Column incurved, semiterete, winged on the magins, produced into a short foot at the base; clinandrium truncate; anther terminal, opercular, incum-

bent, very convex, sometimes crested on the back, 1-celled; pollinia four, waxy, broadly ovate, compressed, without appendages, on the dehiscence of the anther attached to an oblong or broad stipe, gland small or dilated Capsule ellipsoid, beakless.

Lip more or less panduriform when spread out, abruptly tapering above to an acute or apiculate apex, with the tapering margins erose-crisped.
Leaves two, large, always exceeding the inflorescence.....*G. mutica*
Leaf solitary, small, shorter than the inflorescence.....*G. mutica* var. *Purpusii*
Lip neither panduriform nor erose-crisped on the upper margin.
Margin of lip prominently long-ciliate.....*G. ciliilabia*
Margin of lip not prominently ciliate.
Lip narrowly lanceolate, acuminate; leaf solitary.....*G. deliciosa*
Lip ovate to ovate-elliptic or elliptic-oblong, not lanceolate; leaves usually two.
Flowers basically yellowish or orange; inflorescence mostly many-flowered and much elongated.
Lip ovate.....*G. superba*
Lip elliptic oblong.....*G. superba* var. *elliptica*
Flowers basically white, light cream-color or tinged with lavender.
Inflorescence usually somewhat elongate, not capitate, usually less than 8 cm. in diameter; sepals 2.5 cm. or less long.....*G. utriculata*
Inflorescence usually more or less capitate, up to 10 cm. in diameter; sepals occasionally up to 4 cm. long.....*G. utriculata* var. *capitata*

1. GOVENIA CILIILABIA Ames & C. Schweinf. in Sched. Orch. **10**: 80. 1930.

Plant about 32 cm. tall; roots fibrous, flexuous, lanuginose. Scape (together with the petioles and lower part of the leaf-blades) enclosed by three very loose tubular imbricating membranaceous sheaths of which the basal one is shortest and the uppermost largest. Leaves two, subopposite, erect-spreading, elliptic, shortly acuminate, about 18 cm. long and 7 cm. wide when expanded, very thin and membranaceous, plicate. Peduncle (incomplete) slender, glabrous, apparently shorter than or about equaling the leaves, provided above with an inconspicuous tubular bract. Raceme loose below, congested at the apex when young. Floral bracts lanceolate, up to 1.9 cm. long, acuminate, membranaceous, 3– to 7–nerved, concave at the base. Flower small, membranaceous. Dorsal sepal elliptic-oblong, subacute, concave, 4– to 5-nerved, 1.3 cm. long, 4.2 mm. wide. Lateral sepals obliquely elliptic-lanceolate, antrorsely falcate, acute, 3-nerved, about 10.5 mm. long and 3.7 mm. wide at about the middle. Petals obliquely oblong-obovate, antrorsely falcate, acute, rounded at the base on each side, 5-nerved, 1.1 cm. long, 5 mm. wide just above the middle. Lip arcuate-recurved in natural position, ovate or ovate-elliptic when spread out, broadly obtuse, 6.5 mm. long, 4 mm. wide near the base, with the lateral margins densely cellular-ciliate. Column thick, arcuate, clavate, 6 mm. long.

This is the only species of *Govenia* which has a distinctly ciliate lip. I have examined the type in the Ames Herbarium. This species is rare in Costa Rica and Panama.

COSTA RICA: Cola de Galla, *Miguel Chacon 1939* (Type).
PANAMA: *Woodson et al. 947*.

2. GOVENIA DELICIOSA Reichb. f. in Bot. Zeit. **10**: 836. 1852.

Plant small, up to 3.5 dm. tall, clothed at the base by several tubular brownish imbricating sheathes which are up to 8 cm. long. Leaf solitary, elliptic, acute, tapering at both ends, articulated with the leaf-sheath, up to 17 cm. long and 4.5 cm. wide. Peduncle slender, provided with two sheathing clasping bracts which are up to 2 cm. long. Raceme laxly few- to many-flowered, up to 14 cm. long. Floral bracts narrowly triangular-lanceolate, long-acuminate, recurved, about as long as the flowers. Flowers white, with short pedicellate ovaries which are up to 1 cm. long. Floral segments narrow, 5-nerved. Dorsal sepal linear-elliptic, obtuse, longitudinally concave, 2 cm. long, 4 mm. wide at about the middle. Lateral sepals strongly falcate, lanceolate, acute, 1.6–1.8 cm. long, about 4 mm. wide. Petals obliquely linear-lanceolate, tapering to the subacute apex, 1.5–1.8 cm. long, about 4 mm. wide. Lip arcuate-recurved in natural position, lanceolate when spread out, tapering to the subacute apex, about 1.5 cm. long, 5–5.5 mm. wide near the base. Column slender, clavellate, arcuate, about 9 mm. long.

Govenia deliciosa is characterized by having only one leaf and a narrowly lanceolate lip. A drawing of a plant in the Reichenbach Herbarium labelled *G. deliciosa* shows a several-flowered raceme with a solitary leaf. The several drawings sketched by Reichenbach illustrate two types of flowers, but one showing a lanceolate lip I take to be the type described.

MEXICO: Puebla, oak forests, Cerro de Chicamole, August, *C. A. Purpus 6464*.

3. GOVENIA MUTICA Reichb. f. in Bot. Zeit. **10**: 856. 1852.

Plant large, up to 7.5 dm. tall, clothed at the base by several large tubular sheaths which are up to 25 cm. or more long. Leaves two, large, exceeding the inflorescence, articulated with the leaf-sheaths, broadly elliptic to elliptic-obovate, abruptly acuminate, plicate, up to 14 cm. wide. Peduncle stout, provided with two or more clasping sheathing bracts which are up to 7 cm. long. Raceme laxly many-flowered, up to 14 cm. long and 6.5 cm. in diameter. Floral bracts chartaceous, elliptic-lanceolate, acute, up to 1.5 cm. long. Flowers white, pinkish white or cream-colored, adorned with reddish brown spots at the apex of the lip and sometimes with a few spots scattered on the other floral segments, having slender pedicellate ovaries which are about 2 cm. long. Floral segments 5-nerved. Dorsal sepal linear to linear-elliptic, narrowly obtuse, 1.2–1.9 cm. long, 2–3.5 mm. wide. Lateral sepals elliptic-lanceolate to narrowly lanceolate, falcate, recurved at the obtuse to acute apex, 1–1.4 cm. long, 2.5–3.8 mm. wide. Petals narrowly elliptic-lanceolate to elliptic-oblanceolate, oblique, subobtuse to

shortly acuminate at the recurved apex, 1–1.6 cm. long, 3.5–4 mm. wide above the middle. Lip arcuate-recurved in natural position, ovate-lanceolate to oblong-subquadrate or rarely obovate in outline, when spread out more or less constricted at about the middle so as to appear panduriform, rounded at the base, with the upper third irregularly crenulate or erose and abruptly tapering to the apiculate apex, 7–9 mm. long, 3.5–4.7 mm. wide at the widest point. Column stout, winged on the margins, 6–7 mm. long. Capsule ellipsoid, pendent, about 3.5 cm. long.

This species is distinguished from other members of the genus chiefly by its somewhat panduriform acute-apiculate lip.

It is highly questionable whether the plant later described by Reichenbach (in Xenia Orchidacea, vol. 3: 46, pl. 220. 1881) as *G. mutica* is identical with his original *G. mutica*. The illustrations and the description appear to have been poorly prepared. Indeed, the illustrations of the lip resemble more nearly the form which I have called var. *Purpusii*.

Govenia mutica occurs as a terrestrial in rich soil among rocks and on rotten logs in tropical forests and jungles, second growth forests and barrancas, up to 1150 m. alt.

MEXICO: Chiapas, *E. Matuda S-187, 1718*. San Luis Potosi, *P. Maury 7036; O. Nagel & E. Dino 6930; C. G. Pringle 5025*. Vera Cruz, *O. Nagel 3593*.

GUATEMALA: Alta Verapaz, *H. Johnson 1002*. Quezaltenango, *A. F. Skutch 1386*. San Marcos, *G. Solas 93*.

4. **Govenia mutica** Reichb. f. var. **Purpusii** (Schltr.) Correll comb. nov.

Govenia Purpusii Schltr., Beih. Bot. Centralbl. **25,** Abt. 2: 412. 1918; Schltr. in Fedde, Repert. Beih. **59,** t. 61, fig. 421. 1931.

Govenia liliacea (Llave & Lex.) Lindl. var. *Purpusii* (Schltr.) L. O. Wms. in Bot. Mus. Leafl. Harvard Univ. **7**: 146. 1939.

Plant small, 1.5–4.2 dm. tall, clothed at the base by several small tubular sheaths which are up to 12 cm. long. Leaf solitary (rarely two when young), small, lanceolate to narrowly elliptic, acute to acuminate, plicate, up to 20 cm. long and 5 cm. wide. Peduncle slender, provided with a solitary sheathing bract just below the inflorescence which is up to 3.5 cm. long. Raceme usually much exceeding the leaf (very rarely shorter than the leaf), few-flowered, up to 6 cm. long. Floral bracts linear-lanceolate, acuminate, up to 1.3 cm. long. Flowers three to eight, white or white with the tips of the segments lavender-tinged, with reddish brown spots on the apex of the lip and often sparsely scattered on the other floral segments, occasionally with reddish cross-striations on the petals. Pedicellate ovaries slender, up to 2 cm. long. Floral segments similar to those of the typical form but sometimes broader.

Florally, var. *Purpusii* is almost identical with the typical form. However, not only does it occur at much higher altitudes, but it has several differences in gross morphology from the typical form. The few-flowered

short inflorescence which normally exceeds the solitary leaf, and the solitary sheath present on the peduncle are obvious characters which separate it from typical *G. mutica*. I have examined an isotype of *Govenia Purpusii* in the Ames Herbarium.

Terrestrial in cool rocky places in pine-oak forests, at high elevations, up to 3600 m. alt.

MEXICO: Colima, *P. Goldsmith 58*. Jalisco, *C. G. Pringle 4419*. Oaxaca, *C. A. Purpus 3613* (Isotype). Vera Cruz, *E. Matuda 1285*. Cerro de San Felipe, *V. Gonzalez & C. Conzatti 703*. Mina. Gro., Teotepec, *G. B. Hinton 14430*.

GUATEMALA: Sololá, *J. A. Steyermark 46984, 47488*.

HONDURAS: Comayagua, *J. B. Edwards 272*.

5. GOVENIA SUPERBA (Llave & Lex.) Lindl. ex Lodd., Bot. Cab. **18**: t. 1709. 1831; Lindl. in Bot. Reg. **21**: t. 1795. 1836 (plate dated 1835).

Maxillaria superba Llave & Lex., Nov. Veg. Descr. 2, Orch. Opusc. 13. 1825.
Govenia lagenophora Lindl. in Bot. Reg. **25**: Misc. p. 46, 1839; in Bot. Mag. t. 8794. 1919.
Govenia fasciata Lindl. in Bot. Reg. **29**: Misc. p. 70. 1843; in Bot. Reg. **31**: t. 67. 1845.
Govenia utriculata (Sw.) Lindl. var. *lagenophora* (Lindl.) Griseb., Cat. Pl. Cub. 265. 1866.
Govenia sulphurea Reichb. f. in Gard. Chron., n.s., **24** (2): 70. 1885.
Govenia platyglossa Schltr. in Fedde, Repert. Beih. **7**: 157. 1920; Schltr. ex Mansfeld in Fedde, Repert. Beih. **57**: t. 56. Nr. 215. 1929.
Govenia stictoglossa Schltr. in Fedde, Repert. Beih. **27**: 79. 1924.

Plant large, up to 10 dm. or more tall, clothed at the base by several large tubular sheaths which are more or less inflated and up to 25 cm. long. Leaves two, large, shorter than the inflorescence, articulated with the leaf-sheaths, broadly elliptic to obovate-elliptic, rounded and apiculate to abruptly and shortly acuminate at the apex, up to 40 cm. long and 15 cm. wide. Peduncle stout, provided with a clasping sheathing bract on the upper third. Raceme elongate cylindric, laxly many-flowered, up to 35 cm. long and 7 cm. in diameter. Floral bracts linear-lanceolate to elliptic-lanceolate, acuminate, somewhat shorter than the pedicellate ovaries. Flowers fragrant, yellow, yellowish brown or greenish yellow, with reddish brown spots on the upper part of the lip, the segments often with a reddish design and occasionally suffused with reddish brown or reddish purple, with slender purplish pedicellate ovaries which are up to 2 cm. long. Floral segments 5-nerved. Dorsal sepal linear-oblanceolate, obtuse, 1.4–2 cm. long, 3–5 mm. wide above the middle. Lateral sepals falcate, lanceolate, obtuse to acute, 9–13 mm. long, 3–5 mm. wide. Petals obliquely elliptic-oblanceolate, falcate, obtuse to subacute, 1–1.9 cm. long, 3.5–6 mm. wide above the middle. Lip arcuate-recurved in natural position, when spread out broadly ovate to ovate-elliptic, rounded to obtuse or apiculate at the apex, 6–11 mm. long, 3.5–7 mm. wide near the base. Column stout, arcuate, winged, 5–9 mm. long.

The inflorescence of this species is a typically elongate cylindric raceme of numerous flowers, being up to 35 cm. in length. The flowers are basically a rich orange or yellow with various markings and designs of reddish

brown or deep reddish purple. They are said to be quite fragrant and expand rapidly, continuing long in perfection.

I have studied carefully the descriptions and illustrations of the synonyms included here and I am of the opinion that they are all referable to *G. superba*. Although there are some differences in the color-designs of the flowers of these concepts, they all possess the basic characteristics of this species.

Although an examination of a photograph of *G. fasciata* in the Lindley Herbarium reveals that it represents the same species as *G. superba*, the inflorescence is somewhat shorter and fewer-flowered than in typical material.

Govenia superba occurs as a terrestrial in moist soil and leaf mold in oak, pine or mixed pine-oak forests and rocky woodlands, up to 3700 m. alt. It is rather frequent in Mexico, and less common in other parts of its range. It has been reported as questionably from Paraguary (as *G. sulphurea*).

MEXICO: Chiapas, *E. Matuda 4541, 4365; O. Nagel & C. E. Monzón 5896.* Colima, *P. Goldsmith 82* (probably). Distrito Federal, *O. Nagel & Juan G. 3027.* Durango, *O. Nagel & J. Gonzales 5024; J. Gonzales 6176.* Jalisco, *J. Navarro 6207, 6167.* Mexico, *G. B. Hinton 8282* (probably), *13098.* Michoacan, *M. Morrow* (*G. B. Hinton 13098*); *E. A. Aiken 1366; C. G. Pringle 5325* (probably); *G. B. Hinton 15086* (probably). Mina. Gro., Petlacala-Buenavista, *G. B. Hinton 14423* (probably), *14431.* Morelos, *O. Nagel 2871; E. Östlund & O. Nagel 1041, 2890, 2953, 6106; C. L. Lundell & Amelia A. Lundell 12327.* Oaxaca, *O. Nagel & Juan G. 6078.* San Luis Potosi, *P. Maury 6863* (probably). Vera Cruz, April 1906, *Alvarado* (probably); *O. Nagel 2841.*

GUATEMALA: Alta Verapaz, *H. von Türkheim II 1927* (probably). Baja Verapaz, *H. von Türkheim II 2343.* Chiquimula, *J. A. Steyermark 30832.* Huehuetenango, *C. & E. Seler 2325.* Quezaltenango, *A. F. Skutch 821.* Santa Rosa, *Heyde & Lux 4619* (probably). Sololá, *J. A. Steyermark 47312.*

SAN SALVADOR: Cerro de San Jacinto, *Calderon 32* (probably).

COSTA RICA: Irazu, La Cañada, *C. H. Lankester 1068.*

PANAMA: Volcán de Chiriquí, Boquete District, *M. E. Davidson 946.*

COLOMBIA: *W. Hopp 152.*

6. **Govenia superba** (Llave & Lex.) Lindl. var. **elliptica** (S. Wats.) Correll comb. nov.

Govenia elliptica S. Wats. in Proc. Am. Acad. **26**: 153. 1891.

This variety differs from the typical form only in that it has an elliptic-oblong lip instead of the characteristic ovate or ovate-elliptic lip of typical *G. superba*. The lip was originally described as being 3 lines (6 mm.) long. However, the lips of the type material in Herb. Gray which I have examined are 8–8.5 mm. long. The color of the flowers, said to be brown with a yellow lip.

MEXICO: Nuevo León, cool rich canyons, mountains near Monterey, June 1889, *C. G. Pringle 2797* (Type).

7. GOVENIA UTRICULATA (Sw.) Lindl. in Bot. Reg. **25**: Misc. p. 47. 1839; in Bot. Mag. **71**: t. 4151. 1845; in Fawc. & Rendle, Fl. Jamaica **1**: 113, pl. 22, figs. 1–3. 1910.

Limodorum utriculatum Sw., Prodr. 119. 1788.

Cymbidium utriculatum Sw. in Nov. Act. Upsal. **6**: 75. 1799; Sw., Fl. Ind. Occ. 1477. 1800.

? *Eucnemis brevilabris* Lindl., Gen. & Sp. Orch. Pl. 161. 1833.

Govenia Gardneri Hook. in Bot. Mag. **65**: t. 3660. 1839 (pl. dated 1838); Lindl. in Bot. Reg. **25**: Misc. p. 38. 1839.

? *Govenia brevilabris* (Lindl.) Hemsl. in Godm. & Salvin, Biol. Centr.-Am., Bot. **3**: 249. 1882–86.

Govenia boliviensis Rolfe in Mem. Torr. Bot. Club **4**: 263. 1895.

Govenia Ernstii Schltr. in Fedde, Repert. Beih. **6**: 43. 1919; Schltr. ex Mansfeld in Fedde, Repert. Beih. **57**: t. 8, Nr. 28. 1929.

Govenia Sodiroi Schltr. in Fedde, Repert. Beih. **8**: 91. 1921; Schltr. ex Mansfeld in Fedde, Repert. Beih. **57**: t. 95, Nr. 371. 1929.

Govenia Powellii Schltr. in Fedde, Repert. Beih. **17**: 51. 1922.

Plant large, up to 9 dm. tall, clothed at the base by several brown scarious tubular sheaths which are more or less inflated and up to 22 cm. long. Leaves two (rarely one), large, articulated with the leaf-sheaths, obovate-lanceolate to oblanceolate or broadly elliptic, obtuse to acute or more or less abruptly acuminate, plicate, up to 6 dm. long and 15 cm. wide. Peduncle stout, provided with one or more clasping sheathing bracts. Raceme laxly few- to many-flowered, 6–15 cm. long, cylindrical. Floral bracts linear-lanceolate to elliptic-lanceolate, acute to acuminate, shorter than the pedicellate ovaries. Flowers white or light cream-colored, often tinged with light purple or lilac on the outer surface and adorned on the inner surface with reddish brown spots and transverse bands and lines of light purple, having slender purplish pedicellate ovaries which are up to 2 cm. long. Sepals 5-nerved; dorsal sepal elliptic-oblanceolate to elliptic-oblong, broadly obtuse to subacute at the apex, 1.3–2.5 cm. long, 3–7 mm. wide above the middle; lateral sepals elliptic-obovate to elliptic, falcate, obtuse, 1–1.5 cm. long, 3–6 mm. wide above the middle. Petals 5- to 6-nerved, elliptic to elliptic-oblanceolate, falcate, oblique, obtuse to subacute, 1–2.2 cm. long, 5–9 mm. wide above the middle. Lip 5-nerved, with a short claw, arcuate-recurved in natural position, ovate to ovate-elliptic when spread out, rounded to obtuse or subacute at the apex, 6.5–12 mm. long, 4–8 mm. wide near the base. Capsule pendent, ellipsoid, about 3 cm. long.

Govenia utriculata and *G. superba* are not very distinct either in vegetative or floral structure. They are best distinguished by the difference in the color of the flowers. However, even in this particular some forms of each species are quite near to some forms of the other. The flowers of *G. utriculata* are commonly white or light cream-colored with pale purple or yellow markings or suffusions. The flowers of *G. superba* are commonly yellow, yellowish brown or orange marked with reddish brown, purplish brown or lavender. The inflorescence of *G. utriculata* is typically short and often congested, whereas that of *G. superba* is usually elongate cylindric and open. The flowers of *G. utriculata* are usually, but not always, larger than those of *G. superba*. In *G. utriculata* the petals are characteristically much broader than the lateral sepals, while those of *G. superba* are usually about as broad as the lateral sepals. This character, however, is variable and intergradations occur. The lips of the two species are apparently of a similar

ovate or ovate-elliptic shape, although in some forms of *G. utriculata* it is often more orbicular-ovate and wider near the base.

I have studied carefully the descriptions, illustrations and some of the types of the synonyms included here and I am of the opinion that they are all referable to *G. utriculata*.

Fawcett and Rendle, who apparently saw the type of *Limodorum utriculatum* Sw. from Jamaica, have clearly described and illustrated the plant found in Jamaica. Indeed, I have depended largely upon them for my conception of this species. Although Fawcett and Rendle stated that the flowers are cream-colored, Swartz (in his Fl. Ind. Occ.) gives the color of the flowers as white.

An examination of a flower from a topotype of *G. Sodiroi* reveals that the lip is not 4-carinate, as it was originally described. The lip is decidedly of an ovate shape, about 7 mm. long, and, when manipulated, slightly cordate at the base.

An examination of a flower from the type collection of *G. Powellii* shows that it is referable to *G. utriculata*. A drawing from the Schlechter Herbarium, supposedly of the type, shows a plant with only five flowers, not the "many-flowered" receme characteristic of *G. utriculata*.

Govenia utriculata occurs as a terrestrial in rich humus of dense moist forests and thickets, up to 3000 m. alt.

MEXICO: Morelos, *J. Gonzales 1031*. Puebla, *C. A. Purpus 3629* (probably). San Luis Potosi, *Edward Palmer 247* (probably).

GUATEMALA: Huehuetenango, *J. A. Steyermark 50603*. Quiché, *A. F. Skutch 1803*. Zacatepéquez, *Rosalió Gómez 889* (probably).

HONDURAS: Yoro, *J. B. Edwards 489*.

COSTA RICA: Alajuela, Alfaro Ruiz, *A. Smith H564*. Corrozal, *M. Valerio 2608*. Las Concavas, *C. H. Lankester 965*.

PANAMA: Chiriquí, *C. W. Powell 205; R. J. Seibert 329; M. E. Davidson 934*.

BAHAMA ISLANDS: Abaco, *L. J. K. Brace 1907*.

CUBA: Camaguey, *J. A. Shafer 891*. Oriente, *Charles Wright 631; J. A. Shafer 8678*. Santa Clara, *J. G. Jack 8106*.

PUERTO RICO: Aybonito, *P. Sintenis 2843*. Maricao, *A. G. Kevorkian 6089*.

HAITI: Tortue Island, near La Vallée, *E. C. Leonard & G. M. Leonard 11237*.

DOMINICAN REPUBLIC: Barahona, *M. Fuertes 726, 1403b*. San Juan, *R. A. & E. S. Howard 9305*.

COLOMBIA: Dept. Valle, *J. Cuatrecasas 18473*. 1898–1901, *H. H. Smith 2490* (probably).

VENEZUELA: near Tovar, *A. Fendler 1395*.

BOLIVIA: La Paz, *Cárdenas 3398*.

BRAZIL: Minas Geraes, *Ynes Mexia 5496*.

ARGENTINA: Dept. Zafi, *S. Venturi 1753*. Prov. de Salta, *Schreiter 3740*. Famailla-Tucuman, *Schreiter 1753*.

8. **Govenia utriculata** (Sw.) Lindl. var. **capitata** (Lindl.) Correll comb. nov.

Maxillaria liliacea Llave & Lex., Nov. Veg. Descr. 2, Orch. Opusc. 12. 1825.

Govenia capitata Lindl. in Bot. Reg. **21**: sub. t. 1795. 1836.

Govenia liliacea (Llave & Lex.) Lindl. in Bot. Reg. **21**: sub. t. 1795. 1836; in Bot. Reg. 24, n.s. **11**: 13. 1838.

Govenia pauciflora Lindl. in Ann. & Mag. Nat. Hist. **10:** 184. 1842.
Govenia alba A. Rich. & Gal. in Ann. Sci. Nat. sér. 3, **3:** 25. 1845.
Govenia Andrieuxii Reichb. f. in Bot. Zeit. **10:** 835. 1852.
Govenia quadriplicata Reichb. f., Beitr. Orch. Centr.-Am. 75. 1866.

This variety is based primarily on size and habit. The more compact raceme is usually (but not always) less than 8 cm. long and is up to 10 cm. in diameter, thus giving to the inflorescence a capitate appearance. The flowers are characteristically longer, the sepals occasionally becoming as much as 4 cm. in length. The flowers often have a stronger suffusion and veining of lavender-purple than in those of the typical form, especially on the inner surface of the floral segments.

An examination of a photograph of a specimen of *G. capitata* in the Lindley Herbarium shows that it is a plant possessing a short raceme of large flowers, the form which is rather frequent in Mexico.

Similarly, a photograph of the drawings of the type of *G. pauciflora* reveals that it is the same as var. *capitata*, the short raceme of six large flowers being characteristic.

A photograph of an analytical drawing of a flower from the A. Richard and Galeotti specimen of *G. alba* in the Paris Museum shows that it is referable to the large-flowered var. *capitata*. Furthermore, a photograph of the type of *G. Andrieuxii* reveals that it is identical with this variety, having the densely congested raceme of large flowers typical of var. *capitata*. Collector's notes on the label state that the flowers are white and "bird-like" with "black spots."

An examination of drawings of the type of *G. quadriplicata* from the Reichenbach Herbarium reveals that it is the same plant as the large-flowered var. *capitata*. The "quadriplicating" of the lip described and shown in the drawing is a natural result of flattening the lip and thus distorting it from its natural arcuate position. For, in flattening the lip, two longitudinal folds on the disc and a fold on each side near the middle result from the excess tissue.

The habitat of the variety is similar to that of the typical from.

MEXICO: Chiapas, *Ghiesbreght 774*. Chihuahua, *W. P. Hewitt 112*. Michoacan. *A. A. Aiken 1148; E. Vera 6876* (Note: This collection has two plants, one unifoliate, the other bifoliate). Morelos, *O. Nagel 2954; O. Nagel & Juan G. 1101; E. Östlund 2840; C. L. Lundell & Amelia A. Lundell 12326; O. Nagel & E. Östlund 2889*. Nuevo León, *C. H. Mueller 2081, 2149; C. H. Mueller & M. T. Mueller 1216, 1021*. Oaxaca, *C. G. Pringle 4711*. San Luis Potosi, *C. C. Parry & Edward Palmer 864*. Mt. Orizaba, *H. E. Seaton 524*. Sierra de San Felipe, *C. G. Pringle 4711*. Hills of Las Canoas, *C. G. Pringle 5019*. "Montagnes de Santa Rosa." *A. Dugès 67*.

GUATEMALA: Guatemala, *John Porter 10; Margaret Ward Lewis 61*. Santa Rosa, *Heyde & Lux 6242*. San Miguel, *J. R. Johnston 1310*.

SAN SALVADOR: Volcán de San Salvador, *S. Calderon 2593*.

HONDURAS: Comayagua, *J. B. Edwards 68*.

COSTA RICA: Naranjo, *H. E. Stork 861*. San Pedro de San Ramón, *A. Brenes (39) 1624, (31) 1242*. Zarcero, Alfaro Ruiz, Alajuela, *A. Smith H852*.

OBSCURE AND EXCLUDED SPECIES

1. GOVENIA LIMBATA Griseb., Fl. Brit. W. Indies. 628. 1864.

This concept consists of the leaves of an *Oncidium* with flowers of a *Cymbidium*.

2. GOVENIA BARBATA Poepp. & Endl., Nov. Gen. ac Sp. **2**: 5. 1838.
This is probably referable to *Eulophia alta* (L.) Fawc. & Rendle.

3. GOVENIA TINGENS Poepp. & Endl., Nov. Gen. ac Sp. **2**: 5, t. 107. 1838; Cogn. in Mart., Fl. Bras. **3**, pt. 5: 380. 1901.

This concept is probably referable to *G. utriculata*. However, Poeppig and Endlicher illustrated three types of lip for this plant when it was originally described. One illustration is a front-side view of a flower of a *Govenia* showing an obtuse lip, another drawing shows a trilobulate lip spread out, and a third shows a side view of the flower of what appears to be *Eulophia alta* (L.) Fawc. & Rendle with a 3-lobed lip. Cogniaux, who cited the Poeppig collection (No. 1621) from Peru accurately describes the lip of this species as ovate-triangular and obtuse.

I wish to express my appreciation to Mr. Charles Schweinfurth for his assistance in the preparation of this paper.

A Comparative Study of Tripsacum australe and its Relatives

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It is now quite certain that the American grass genus Tripsacum plays a role of great importance in the botanical history of maize. Mangelsdorf and Reeves (1939) have presented evidence that Tripsacum is not only one of the parents of teosinte (*Zea mexicana* (Schrad.) Reeves & Mangelsdorf) but that it has contributed some characteristics to most of our North American maize and to some of that grown in Central and South America. These authors also present evidence that a pod corn-like plant was the progenitor of cultivated maize. Recent studies lend support to these views.

There are seven species of Tripsacum, all found in the New World (Cutler & Anderson 1941). *Tripsacum floridanum*, restricted to a part of Florida, greatly resembles *Manisuris cylindrica* in the area occupied, the size of the plant and inflorescence, and in the variation in plant colors and sculpturing of the exposed glume. The *n* number of chromosomes of *M. cylindrica* is 9; that of *T. floridanum* is 18. *T. dactyloides* grows in Texas, Missouri, Illinois, New York, Connecticut, and to the southeast. Plants from Kansas and Texas have been shown to be diploids ($n = 18$) while some from Texas and those from the east are tetraploids ($n = 36$) (Mangelsdorf and Reeves 1939; Anderson 1944a). The morphology of *T. dactyloides* has been described by Weatherwax (1918) and that of the other species differs but little. *T. lanceolatum* grows from Arizona to Central Mexico. This species has been studied very little. *T. pilosum*, *T. laxum*[2] and *T. latifolium* all vary greatly in structure and in some characteristics they resemble the maize of Mexico and Central America. This suggests that they may be contaminated by maize, just as maize probably is contaminated by Tripsacum, probably from backcrossing to teosinte. These three species are tetraploids ($2n = 72$) and usually do not produce viable seeds. In a cytological study of *T. laxum*, Dodds and Simmonds (1946) suggested that this species is an amphidiploid.

The most interesting species is *Tripsacum australe* Cutler and Anderson. It grows in northern Paraguay, in Mato Groso, Amazonas and Acre in Brazil, and in the similar lowlands of Bolivia, Peru, Ecuador, Colombia, Venezuela and southern British Guiana. Throughout the area of distribution it nearly always occupies the same type of habitat, the margin between grassy open areas and woods. In the Chaco of Bolivia and Paraguay

[1] Guggenheim Fellow 1942–43, 1946–47. The plants on which these studies were made were grown in the experimental plots of Dr. F. G. Brieger at Piracicaba, São Paulo, Brazil, and of Dr. Martin Cardenas at Cochabamba, Bolivia. The author is indebted to Dr. Brieger and Dr. Cardenas for their kindness in providing space and assistance for this work.

[2] *T. laxum* is the correct name for this species. *T. fasciculatum* Trin. is invalid since there is the earlier *T. fasciculatum* Rasp. which is a synonym for *Chloris radiata*.

and in the savannas of Mato Groso and the eastern part of the Department of Beni of Bolivia, *T. australe* forms a narrow belt around many of the small islands of trees in the open grasslands, only rarely extending into the woods or the grasslands.

Most commonly the plant looks like a very robust specimen of *T. dactyloides*, but often it is much smaller and may even look almost like a clump of Manisuris. Frequently it is a huge clump nearly ten feet tall. This is the most common type near Reyes, Bolivia. Occasionally the plants are prostrate and crawl along the ground or clamber over shrubs and low trees for as much as twenty feet. These vine-like plants usually have many adventitious roots, sometimes on twelve nodes, and have few or no branches. They are more common in Mato Groso.

The leaf sheaths of *T. australe* are invested with stiff hairs, unlike the softer hairs of *T. pilosum* or the maize of the Mexican Plateau, but very similar to those of *T. lanceolatum* or the maize of part of the region drained by the upper Rio Beni, a race of maize called "Coroico" by Cutler (1946).

Because of its slender leaves the Coroico maize plant has the most grass-like appearance of any cultivated maize (this does not include such mutants as teopod or some of the dwarfs). In several respects it resembles *T. australe*. One of the most striking similarities is a strong response to length of day. Seeds from plants which mature near Coroico in about five months and have few or no tillers produce plants which mature in seven months and frequently have six or seven tillers when grown in Cochabamba, about two hundred miles south and a thousand meters higher.

T. australe plants are usually light green, though slightly reddish plants are not uncommon, and in Mato Groso red and purple culm, midrib, glume, rachis, anther and silk colors are frequently seen. There are only slight differences in seed color, although several seeds of Mato Groso plants were purple-brown instead of the usual dark honey-color. Since the maize of most of the lowlands is quite uniformly white or yellow to orange in color because most other colors are inhibited by a dominant gene, it is possible that the absence of a wide range of seed and plant colors in Tripsacum is brought about by a similar gene.

The unique appearance of the maize ear and tassel has aroused considerable interest and study of these structures as well as other grasses of the same tribe (see the recent papers by Anderson 1944b, Mangelsdorf 1945, and Weatherwax, especially his "Phylogeny of Zea Mays" 1935). The inflorescence of *T. australe* is much more variable than that of *T. dactyloides* or of those colonies of *T. lanceolatum*, *T. pilosum* and *T. laxum* which I have been able to study. Like many of the Andropogoneae, the spikelets of Tripsacum are arranged alternately in cavities in the rachis. Some of the spikelets are set so deeply that the margins of the rachis partially enclose them. Structures similar to these flaps of the rachis are char-

acteristically found in some maize, especially that of United States and Mexico. These rachis flaps are usually absent in prehistoric South American and in modern South American Andean maize.

The upper portion of the Tripsacum inflorescence bears only staminate spikelets. These are arranged in pairs, one sessile and the other almost imperceptibly pedicellate, a feature also common in the Andropogoneae where the spikelets, however, are usually perfect. The basal portions of the inflorescence are pistillate and the spikelets are usually borne singly in the alveoles. The terminal inflorescence contains very few pistillate spikelets compared with the number of staminate ones, whereas in the lower lateral inflorescences the number of pistillate spikelets is much greater. Usually the terminal inflorescence has two or three branches but may have as many as six. The lateral inflorescence is usually unbranched. Seeds from Tripsacum growing near Reyes, Bolivia, are usually viable, but good seeds are rare in plants growing south of Aquidauana, Mato Groso, Brazil.

The inflorescence is not surrounded by any protecting leaves or bracts except in occasional instances when the last node is short and the inflorescence is enveloped by a leaf. This leaf does not originate immediately at the base of the inflorescence as do the bracts which envelope each branch of the teosinte inflorescence, but arises at the next node below. In neither Tripsacum nor teosinte have I been able to discover any structure which would correspond exactly to the bract which subtends the paired spikelets in the maize mutant, teopod. The closest resemblance is in the bracts about each branch of the teosinte inflorescence, for if we are willing to believe that each pair of spikelets represents the remnant of a lateral branch, it is likely that the branch was subtended by a bract. At the base of each pair of spikelets in maize there is a line which represents the node. In teopod this is just below the bract. Teopod ears superficially resemble pod corn but the grains of pod corn are covered by the enlarged glumes, lemmas and paleas, not by a bract.

Although the pistillate spikelets of Tripsacum are usually borne singly, paired spikelets are frequently seen. Kempton (unpublished notes) mentions finding a few in Mexican species and Weatherwax (1935) pictures a pair in *T. dactyloides*. In *T. australe* it is possible to find a complete series of second spikelets, from scarcely discernible vestiges through sterile pedicel-like structures, staminate spikelets, pedicellate non-functional pistillate spikelets, to normal well-developed seed-bearing spikelets almost identical to the first of the pair. The arrangement of the pair of spikelets on the pistillate part of the spike is always the same. The second of pedicellate spikelets of the pair are always adjacent and, of course, so are the first or non-pedicellate spikelets. This is the same arrangement as on the staminate part of the spike of Tripsacum, on the branches of the maize tassel, and on some ears of segregates from teosinte-maize crosses. This series of inter-

grades from practically no vestige of a second spikelet to a completely developed and functional spikelet is not peculiar to *T. australe*. It is common in South and Central American maize and ears with no visible second spikelet, with a pedicellate staminate second spikelet and with scarcely developed non-functional ones can be found. It is also common in several other grass genera, not only in the Andropogoneae where paired spikelets characteristically occur, but in the Paniceae and several other tribes. An interesting discussion and series of drawings illustrating these conditions in various genera is given by Helm (1934).

A study of single *vs.* paired pistillate spikelets has been made by Langham (1940) in maize-teosinte crosses. Langham concluded that the single pistillate spikelet of teosinte is governed by a single gene which is recessive to paired spikelets. In his studies he discovered an inbred line of maize which possessed single spikelets. Because there are varied degrees of pairedness, it is likely that more than one gene is involved. Langham's report does not include observations on single *vs.* paired spikelets in the tassel. The presence of single spikelets in the maize ear probably is correlated with a similar expression in the central spike of the tassel, for morphological changes controlled by genes for tunicate teopod, tassel seed, silky and many other characters affect both ear and tassel. In a line of Brazilian hard orange flint, called Cateto in Brazil, several ears consistently had from ten to as many as thirty-three of the second spikelets represented by pedicellate staminate spikelets. The tassel of only one of these plants was saved. This had several solitary staminate spikelets in the central spike. Since this is occasionally true of plants with normal ears, more observations are needed before any tassel change associated with solitary spikelets on the ear can be considered as definitely present.

The character of a pair of spikelets in teosinte-maize hybrids is partially determined by their position on the spike. Any pair with fertile pistillate flowers is found among the lowermost pairs of spikelets. Above are found a series of forms, beginning with paired spikelets which have one spikelet with a weakly developed or even completely aborted pistillate flower. Higher still may be types in which one of the spikelets bears a non-functional staminate spikelet or occasionally a functional one. Above this are the normal paired staminate spikelets.

In Tripsacum the spikelets immediately below the staminate portion of the inflorescence are frequently paired. This may be considered as an extension of the paired spikelets always found in the staminate portion, and such paired spikelets are found on only a very few spikes of a clone. When paired spikelets occur in the lower pistillate segments of the inflorescence, paired spikelets are usually found on many other inflorescences of the same clone. Since paired spikelets are not common, the limits of any clone bearing this character are readily determined.

In determining which plants are part of a single clone, the color of the stigma, purple, pink or white, was useful but not as critical as paired spikelets because the number of clones with each color is high. Only one other character proved as reliable in the study of clone size. This was the presence of three branched stigmas, a characteristic limited to most of the inflorescences of only one clone.

Only two spikelets out of about 600 which were opened were found to have both the upper and lower florets developed. Even if one considers the fact that only the larger spikelets, and these would be the ones most likely to have two grains, were examined, the proportion of double-grained spikelets is much greater than in the maize of South America. The structure of the double-grained spikelet is similar to that in maize (Cutler 1945). The upper floret, which is the one usually developed, bears a grain with the embryo facing the tip of the spike. The lower floret bears a grain with the embryo facing the base.

A complete study of the morphology of *Tripsacum australe* obviously cannot be made from herbarium material alone, nor even from studies of the plants in the wild. It will be necessary to inbreed the plants to discover recessive characters, or even those dominants which are suppressed by inhibitors. We have seen how *T. australe* resembles maize in many characters. We know that many races of maize are fasciated and that the ear of maize might have originated as a fasciation. Perhaps inbreeding *T. australe* could uncover a recessive fasciation gene which would be capable of controlling the formation of an ear-like structure in Tripsacum.

Graner and Addison (1944) found that a clone of the large and robust *T. australe* from Mato Groso, Brazil, had 18 pairs of chromosomes (2 *n*) and differed distinctly from other species in lacking terminal knobs on the chromosomes. A cytological examination of some of the smaller and more Manisuris-like clones might reveal a form with nine pairs of chromosomes. We might even expect this to be an annual or a weak perennial, for annual teosinte is a diploid while perennial teosinte is a tetraploid. *If such a Tripsacum is discovered* we can make a good case for Tripsacum as the ancestor of maize even though maize has ten pairs of chromosomes. By fragmentation of one chromosome at the point of attachment, as has been described in maize (McClintock 1932) and wheat (Smith 1947), the chromosome number could be increased. An even more satisfactory method would be the duplication of a single chromosome, for if the chromosome which was duplicated happened to carry a recessive gene for fasciation of the inflorescence, a maize-like plant could be produced almost at once. After numerous generations of cultivation, with crossovers and occasional mutations, we would not expect to discern much similarity between the two chromosomes.

Unfortunately no Tripsacum plant with nine pairs of chromosomes has

so far been found. Even though *Tripsacum australe* resembles maize more than any other species of Tripsacum, most of these similarities can also be found in other grasses. Yet *T. australe* remains a very promising material in the study of the origin of maize.

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A Morphoplastic Interpretation of the Amphivasal Bundle in Ranunculus[1]

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This investigation was prompted by the discovery of a particularly large stem of *Ranunculus acris* L. whose normal collateral vascular bundles were accompanied by others which showed transitions between the collateral and the amphivasal (leptocentric) types.

Camera lucida drawings of the cross-sectional aspect of the normal bundle, and the stages intermediate between it and the fully developed amphivasal bundle are shown in Figs. 1–4. Figure 1 illustrates a typical collateral bundle of *Ranunculus acris*. It consists of a bundle sheath, phloem, xylem, and a weakly-developed cambium which has cut off a few secondary cells. Figure 2 represents a modification of the typical collateral bundle where the xylem has assumed a U-shaped form and has partially surrounded the phloem. In this figure the cambium is seen to be somewhat more reduced in activity, though it is still capable of forming a few outer xylary elements and a few inner sieve tube elements. The sclerenchymatous sheath has invaded the primary phloem region in such a way that the latter presents much the same U-shaped form as does the xylem. In Figure 3, the two arms of the U-shaped xylem are approximating the form of a complete circle. Figure 4 illustrates a typical amphivasal bundle. A cylindrical hollow mass of wood surrounds the primary phloem which, in its turn, encloses a central core of mechanical tissue. Cambial activity is still evident. One or two rows of secondary xylary elements and a few rows of centripetal sieve tube elements have been formed.

Thus this series of morphoplastic changes indicates a sequence of gradual transformations through which the amphivasal bundle arises from the collateral bundle. From the primitive collateral strand, arms of xylem gradually extend outward to the right and left in the form of a U, pinching off a rod of mechanical boundary tissue, and eventually completely encircling the phloem. The cambium is carried along in this process, and its activity is evident in each stage. This amphivasal bundle thus differs from the more typical monocotyledonous homologue in its "open" condition, with a functional but greatly reduced cambium, and in the rod of sclerenchyma which occupies its center.

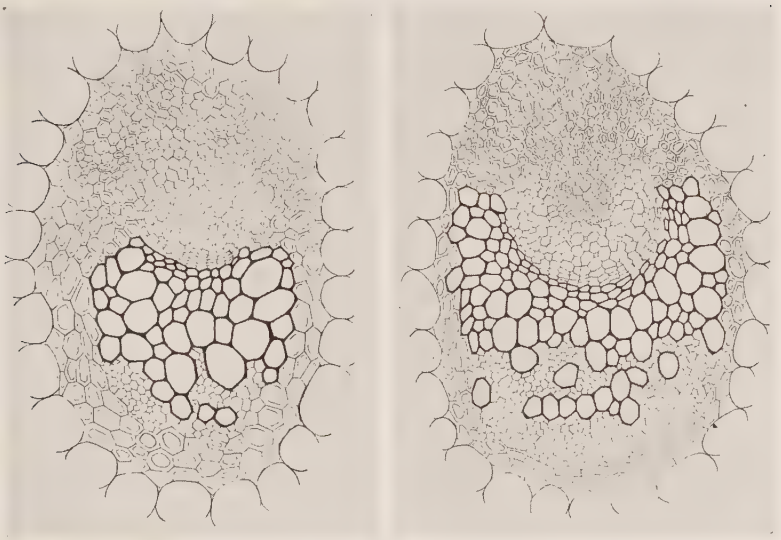
As early as 1866, Van Tieghem recognized the difference between the collateral bundle and the concentric bundle, both of which occur in the rhizome of *Acorus gramineus*, and gave a morphogenetic description of the

[1] The author wishes to express his appreciation to Dr. Ray E. Torrey, University of Massachusetts, for his suggestion and guidance of this investigation.

latter. He noted that in the early stages of its formation, the xylem is tangentially arc-shaped in cross-sectional aspect, and that by the addition of xylary elements to both ends of the arc, a semi-circular and finally a completely circular arrangement of the xylary mass results. Chrysler (1904), and later Arber (1925) supported this interpretation in the aroids, indicating that those bundles having Y-, U-, or V-shaped xylary tracts are transitional to the fully concentric type. Chrysler (1906), however, gave a different interpretation to the morphogenesis of the amphivasal bundle in grasses. Internodal regions of these plants generally exhibit a ring of collateral bundles, but in the nodal region their number is so measurably increased by the entrance of leaf traces that their mutual crowding appears to have forced some of them into the central region of the stem, whereupon they may rotate through 180 degrees and fuse—the phloem of one uniting with the phloem of another, while the xylem surrounds the whole. Worsdell (1915) noted a somewhat similar phenomenon in the cucurbits where two collateral bundles are approximated without rotation, the innermost bundle losing its xylem and the fusion product becoming a bicollateral bundle.

The appearance of the amphivasal bundle in advanced herbs appears to illustrate what Bower (1930) termed "the principle of Size and Form." As a solid body enlarges, maintaining the same form, the surface increases as the square of the linear dimensions while the volume increases as the cube. Inasmuch as physiological interchange occurs through limiting surfaces, the amount of such interchange being proportional to the surface area, it is readily seen that in a growing body while the mass is increasing as the cube of the linear dimensions, the surface increases only as the square, and thus there is a constant approach to a state of physiological inefficiency provided the original form remains unchanged. Any change in form which gives a more complicated contour tends to restore the proper physiological proportion of surface to bulk.

Applying this principle to the xylary tract we note that one of the limiting surfaces through which physiological interchange occurs is the collective surface of contact between the dead and living cells of the xylem. Bower points out that the greatest morphoplastic changes are found in plants whose conducting strands are composed largely of primary tissues. In small axes, modification of the primary skeleton alone suffices to maintain physiological efficiency. This is accomplished in several ways: by medullation, sculpturing of the surface, disintegration of the xylem into vascular bundles, or by scattering parenchyma through the xylem (intravitalization). But intra-vitalization also made possible the large dendroid type, which arose with the formation of a cambium and the simultaneous introduction of the vitalizing vascular ray. That the secondary wood of the dendroid type is remarkably vitalized is indicated by the distribution



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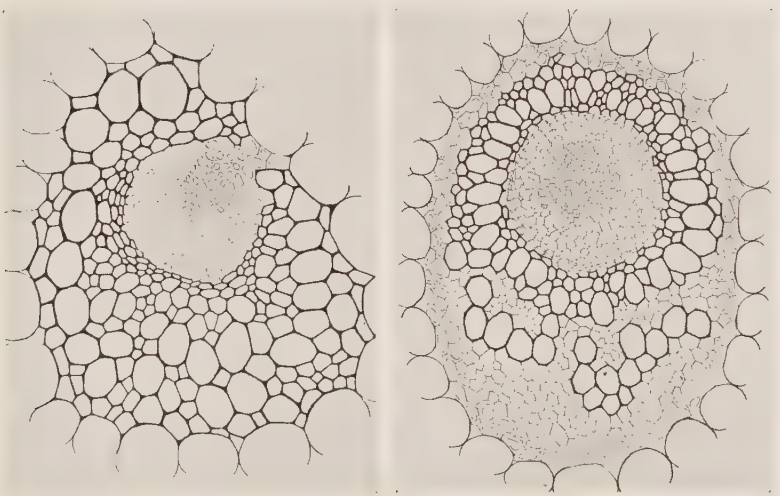

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FIG. 1. Typical mature collateral bundle of *Ranunculus acris*. ×300.

FIG. 2. Vascular bundle of *Ranunculus acris* in which arms of xylem partially surround the phloem. ×300.

FIG. 3. Incompletely mature vascular bundle of *Ranunculus acris* showing more complete encircling of the phloem by xylary elements. The sclerenchymatous sheath is not completely differentiated. ×300.

FIG. 4. Amphivasal bundle in *Ranunculus acris*. ×300.

of living wood-parenchyma and vascular rays in such a fashion that each dead conducting element is in contact with at least one and sometimes as many as six living cells. From the standpoint of vitalization, the tree would appear to be physiologically efficient. With its vitalized secondary wood, there has been a correlative lack of change in form of the primary tissues; the physiological demands of an enlarging axis are maintained solely by cambial activity.

The annual herb, however, which has arisen from the tree by the gradual reduction of cambial activity and attendant loss of secondary tissues (Jeffrey and Torrey, 1921; Sinnott and Bailey, 1914), is held to represent the extreme expression of physiological efficiency. A cross-section of an internodal region of a typical dicotyledonous herb shows a ring of vascular bundles traversing the ground parenchyma, and practically devoid of cambial activity. This is the condition found in the normal stem of *Ranunculus acris*.

With the origin of the annual herb and the practical loss of secondary wood, the plant must maintain itself almost entirely by this previously static primary wood. Yet vegetative and reproductive efficiency are greatly increased in the herb just at the time when the conducting tract is decreasing markedly in amount. In this situation, three morphoplastic possibilities are open to the plant: (1), the number of collateral bundles may be increased; (2), the individual collateral bundle may be enlarged; and (3), the individual bundle may undergo some change in form in consonance with the principle of Size and Form.

Physiological demands may be met by increase in number of bundles only up to a limit which is physically defined by the size and shape of the herbaceous stem. Demands beyond this limitation cannot be met by increase in the number of bundles but may be satisfied by increase in the size of the individual bundle. That this has been accomplished to some degree is attested by the fact that the primary xylem mass of the herbaceous stem is much greater in quantity than the insignificant remnant which occurs in woody stems. However, according to the principle of Size and Form "there is an advantage in the increasing complication of form as against any mere magnification of the original image." After reaching a certain size, the limits of physiological efficiency in the collateral bundle are reached, and any further increase in size leads only to a decrease in the proportion of surface to bulk in the vitalization of the dead xylem. Consequently, a more logical step would be a change in form which would bring a greater number of xylary elements into contact with the living phloem. Such a morphoplastic change seems to be actually occurring in the particular stem of *Ranunculus acris* under discussion, and the amphivasal bundle is the outcome.

That the amphivasal bundle is physiologically superior to the collateral bundle is indicated by its occurrence in regions of high specialization. For

instance, it is of almost universal occurrence in the efficient storage rhizomes of the monocotyledons. The studies of Chrysler (1906), Plowman (1906), and others have shown that it occurs in the nodes of grasses and sedges, often surrounded by a chlorenchymatous ring, thus being highly vitalized. Avery (1930) has described the coleoptile of corn as having two half-amphivasal bundles, and Arber (1925) has described typical amphivasal bundles in the coleoptiles of other grasses. Chrysler (1906) has shown that they occur in the inflorescence axis of corn. These instances are hardly indicative of their persistence in "conservative" plant organs as maintained by Chrysler (1906), but emphasize rather their occurrence in regions of great metabolic activity. In this connection it is interesting to note that Strasburger (1891) regarded the amphivasal bundle as the physiologically superior type for the taking up of reserve food materials stored in the rhizome. Similarly Haberlandt (1884) suggested that the amphivasal bundle has been formed to bring the greatest number of vessels into contact with the surrounding storage tissues.

To test these views I studied the vascular bundles of the rhizome of *Acorus calamus* L., a plant belonging to a group which stands on the borderline between the monocotyledons and dicotyledons, and possibly related to the Ranunculaceae. Normally the rhizome of *Acorus calamus* carries both collateral amd amphivasal bundles.

A comparison of phloem-xylem contacts in the two bundle types is given in Table 1.

TABLE 1

	Average total number of phloem cells in contact with xylem (A)	Average total number of xylary elements in contact with phloem (B)	Proportion of contact between cells of the phloem and xylem (A/B)
Collateral Bundle	14.7	7.4	1.98:1
Amphivasal Bundle	33.3	17.9	1.86:1

From these figures we may draw two conclusions: (1), that the number of living phloem cells in contact with each dead xylary element averages about the same in both concentric and collateral bundles; and (2), that the total number of xylary elements in contact with the phloem mass is over twice as great in the amphivasal as in the collateral bundle. The first conclusion seems to indicate that a minimum number of phloem cells must be in contact with each xylary element regardless of the form of the entire xylem mass, while the second conclusion shows that the xylem of the amphivasal bundle is much more highly vitalized than is that of the collateral bundle. The xylem of the amphivasal bundle has taken the form of a hollow cylinder and the proportion of its contact with the living cells of the phloem has been more than doubled.

These conclusions provide the most reasonable explanation for the formation of the amphivasal bundle. The ensheathing of the phloem by the xylem is a correlate of the increasing demands of the vegetative system, and represents the present end of a phyletic series of morphoplastic changes contingent upon the loss of secondary wood.

CONCLUSIONS

A study of an aberrant stem of *Ranunculus acris* disclosed the steps by which a phyletic morphoplastic change from collateral to amphivasal bundle was probably effected. Two arms of xylem rise in crescentic form to encircle the phloem. Incidentally they cut off a portion of the sclerenchymatous sheath which is included with the phloem inside the xylary ring.

The principle of Size and Form (Bower, 1930) appears to underlie this transformation, as the "vitalization" of the amphivasal bundle is shown to be superior to that of the collateral. Therefore, the amphivasal bundle does not always owe its genesis to crowding of the vascular strands, but may arise in response to increasing physiological demands for a greater amount of contact between dead xylem and living phloem.

There is no assurance that the amphivasal bundle represents the terminus in the series of morphoplastic changes. The simple siphonostele, to which the amphivasal bundle presents a certain analogy, is by no means the ultimate stelar elaboration in the lower groups of ferns and lycopods. As corrugation, dictyostely, perforation and polycycly are all later modifications of the siphonostele, parallel elaborations of the individual bundle may well be expected. In fact, according to Worsdell's (1902) interpretation, certain cycadean concentric medullary bundles ("star rings") have already fragmented and may possibly point the way along which the monocotyledons may yet advance.

SUMMARY

1. The amphivasal bundle is a derivative of the collateral bundle. In all probability an abnormal stem of *Ranunculus acris* provides a key to the phyletic process. Two opposed arms of xylem gradually embrace the phloem, at the same time pinching off a portion of the bundle sheath which becomes isolated as a central sclerenchymatous rod.

2. The amphivasal bundle in this Ranunculus stem did not arise as a result of crowding of vascular strands rather its genesis apparently represents a response to the increasing physiological demands of an annual herb necessitating a greater number of contacts between living and dead cells.

3. The amphivasal bundle is more highly vitalized than the collateral

bundle and in this respect is physiologically more efficient than its assumed forerunner.

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Florida Polypores

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Polypores are mostly tough or woody fungi found chiefly on wood in the form of brackets of various shapes and sizes, the fruiting surface being composed of tubes or furrows. In one large group there is no pileus, the tube-layer being simply spread out over an old log or other host. From the tubes of polypores mature spores emerge in countless numbers, reaching into the millions, and are carried by the wind to places where they germinate and form other colonies. Polypores growing on dead wood assist other organisms in reducing their hosts to humus, while species that are able to attack living trees may be very destructive in the forest. Treatment is largely preventive, including fire protection, the prompt covering of wounds, and anything else that will keep the spores from gaining an entrance to the body of the tree.

The classification here followed is that used by the author in "North American Flora" Vol. 9, parts 1 and 2, and in various articles published by him in "Mycologia," the "Torrey Bulletin," etc. The older men have criticised this classification mainly because they learned the cumbersome "sections" of the genus *Polyporus*. Younger men have eagerly welcomed the simpler groups, each with its own generic name. In order to satisfy both classes of students the old and the new names are both used in the following pages. One must bear in mind that a genus is simply a collection of similar species, and that classification is a matter of convenience.

Polyporaceae

Hymenophore annual or perennial; context usually fleshy-tough, corky, or woody; hymenium poroid or lamelloid, fleshy to woody, never gelatinous. (See Meruliaceae).

Hymenophore entirely resupinate, never reflexed ..... Tribe 1. Porieae
Hymenophore commonly pileate but often effused-reflexed, sometimes varying to resupinate.
  Hymenium porose.
    Hymenophore annual ..... Tribe 2. Polyporeae
    Hymenophore perennial ..... Tribe 3. Fomiteae
  Hymenium furrowed ..... Tribe 4. Daedaleae

Tribe 1. porieae

Hymenophore some shade of white, gray or yellow.
  Hymenophore annual ..... 1. Poria
  Hymenophore perennial; tubes white or pink ..... 2. Perenniporia
Hymenophore some shade of purple or red.
  Spores hyaline ..... 3. Physisporinus
  Spores fuscous ..... 4. Meruliporia

Hymenophore brown.
Hymenophore annual.
Hymenium irpiciform ..... 5. Hydnoporia
Hymenium normally poroid.
Spores hyaline ..... 6. Fuscoporia
Spores brown ..... 7. Fuscoporella
Hymenophore perennial.
Spores hyaline ..... 8. Fomitiporia
Spores brown ..... 9. Fomitiporella
Hymenophore black
Hymenophore annual ..... 10. Tinctoporia
Hymenophore perennial ..... 11. Melanoporia

Tribe 2. POLYPOREAE

Context white.
Hymenophore sessile.
Tubes hexagonal, in radiating rows ..... 21. Hexagona
Tubes primitive; hymenium soon irpiciform ..... 12. Irpiciporus
Tubes normally poroid, sometimes irpiciform with age.
Context duplex; surface sodden and bibulous ..... 17. Spongipellis
Context not duplex.
Pileus fleshy-tough to woody and rigid.
Surface anoderm, rarely zonate.
Hymenium smoke-colored ..... 18. Bjerkandera
Hymenium white or pallid.
Context fleshy to fleshy-tough, friable when dry ..... 16. Tyromyces
Context punky to corky, not friable when dry ..... 19. Trametes
Surface pelliculose, usually zonate ..... 20. Rigidoporus
Pileus thin, leathery, usually flexible and zonate.
Hymenophore borne on a sterile cup ..... 13. Poronidulus
Hymenophore not as above.
Hymenophore normally pileate ..... 14. Coriolus
Hymenophore semi-resupinate ..... 15. Coriolellus
Hymenophore stipitate.
Stipe compound ..... 26. Grifola
Stipe simple.
Hymenophore fleshy, terrestrial ..... 25. Scutiger
Hymenophore tough, epixylous.
Tubes hexagonal, radially elongate ..... 21. Hexagona
Tubes not as above.
Context duplex, spongy above ..... 24. Abortiporus
Context homogeneous, firm.
Pores minute, surface usually zonate ..... 22. Microporellus
Pores not minute, surface azonate ..... 23. Polyporus
Context bright-colored; some shade of red or yellow.
Pores red or orange.
Tubes unchanged on drying ..... 27. Pycnoporus
Tubes dark and resinous when dry ..... 28. Aurantiporus
Pores yellow; hymenophore very large ..... 29. Laetiporus
Context some shade of brown.
Hymenophore sessile.
Spores hyaline.
Context light-brown.
Surface glabrous or nearly so ..... 33. Hapalopilus
Surface distinctly hairy.
Tubes small and regular ..... 31. Coriolopsis
Tubes large and irregular ..... 32. Funalia

Context dark-brown.
Context friable.....38. Phaeolus
Context tough.
Tubes some shade of brown, rarely greenish.
Tubes entire.
Surface heavily bearded.....34. Pogonomyces
Surface not bearded.....31. Coriolopsis
Tubes soon splitting into teeth.....30. Cerrenella
Tubes black.....35. Nigroporus
Spores brown.
Hymenophore thin, dry, multizonate.....36. Cycloporellus
Hymenophore not as above.....37. Inonotus
Hymenophore stipitate.
Spores hyaline.....38. Phaeolus
Spores brown.
Pileus inverted, pendant.....39. Coltriciella
Pileus erect, stipe central.....40. Coltricia

Tribe 3. FOMITEAE

Surface covered with reddish-brown varnish.....49. Ganoderma
Surface not as above.
Context white, rosy or wood-colored.....41. Fomes
Context olivaceous.....42. Fomitella
Context brown, dark-red, dark-purple or black.
Surface not encrusted; or, if so, context woody.
Context brown or latericious.
Hymenium porose.
Spores hyaline.....43. Pyropolyporus
Spores brown.....44. Fulvifomes
Hymenium porose-daedaleoid.....45. Porodaedalea
Context dark-purple or black.....46. Nigrofomes
Surface encrusted; context punky.
Spores hyaline.....47. Elfvingiella
Spores brown.....48. Elfvingia

Tribe 4. DAEDALEAE

Context white or wood-colored.
Hymenium labyrinthiform, often becoming lamellate or irpiciform.
Hymenium very soon irpiciform.....50. Cerrena
Hymenium rarely irpiciform and then only at maturity.....51. Daedalea
Hymenium lamellate from the first, not becoming irpiciform.....52. Lenzites
Context brown.....53. Gloeophyllum

1. PORIA (Pers.) S. F. Gray

Hymenophore resupinate, epixylous, usually thin, effused, annual, white, gray or yellow; tubes not stratose, thin-walled, usually slender; spores hyaline.

Hymenophore unique in some way.
Developing on a "tuckahoe"..... 1. *P. cocos*
Hymenium serpentine, white..... 2. *P. subserpens*
Tubes 5–6 mm. long, deep-yellow..... 3. *P. luteofibrata*
Tubes 1–3 mm. long, orange-yellow..... 4. *P. subradiculosa*
Tubes 3–5 mm. long, flavous, the edges becoming deep-roseous..... 5. *P. Rhoadsii*
Tubes 2–3 mm. long, whitish to pale-rosy-isabelline..... 6. *P. floridae*
Tubes 1–2 mm. long, pale-avellaneous..... 7. *P. subavellanea*

Tubes 1–3 mm. long, cinereous ..... 8. *P. caryae*
Tubes merulioid, white to buff ..... 9. *P. reticulata*
Margin ferruginous, tubes white to brownish-discolored ..... 10. *P. ferruginicincta*
Hymenophore lacking special distinction.
Hymenophore rather thick, reaching 4 mm. or more.
Tubes 2–5 mm. long, 1–3 to a mm.
Tubes becoming daedaleoid ..... 11. *P. heteromorpha*
Tubes not becoming daedaleoid ..... 12. *P. ambigua*
Tubes smaller
Hymenium glistening, white, dark-isabelline where bruised .. 13. *P. cubitispora*
Hymenium not as above.
Spores 3–4μ long ..... 14. *P. alachuana*
Spores 4.5–6μ long ..... 15. *P. subacida*
Hymenophore thin, rarely over 2 mm. thick.
Tubes 1–3 to a mm.
Spores 4.5–6×3–4μ; tubes cinnamon-buff ..... 16. *P. versipora*
Spores 4–6×1–2μ; tubes yellowish ..... 17. *P. vaporaria*
Tubes 4–5 to a mm.
Hymenium becoming brownish ..... 18. *P. polyporicola*
Hymenium white or yellowish.
Spores subglobose, 2.5–3μ ..... 19. *P. mollusca*
Spores ellipsoid, 4×2.5μ ..... 20. *P. Calkinsii*
Spores curved in a half circle, 3–5×1–2μ ..... 21. *P. lenis*
Tubes 10 to a mm.; spores globose.
Spores 2μ in diameter ..... 22. *P. lacteimicans*
Spores 3–4μ in diameter ..... 23. *P. holoseparans*

1. PORIA COCOS Wolf, Jour. Mitchell Soc. **38**: 127. 1922

Pachyma cocos (Schw.) Fr. *Sclerotium cocos* Schw.

Hymenophore tough, resupinate, annual, tubes 2–4 mm. long, at first creamy-white, at length chocolate-brown, mouths large, angular to irregularly sinuous, spores cylindric, obliquely apiculate at the base, smooth, hyaline, 7–8×3.5μ, cystidia none.

The first recorded fructification of the southern tuckahoe was observed on a specimen brought from Florida and kept several months in the author's office in New York as a curiosity. The first published account of a fruiting tuckahoe was by Wolf in Jour. Mitchell Soc. **38**: 127. 1922. An article on the tuckahoe in Florida, by Weber, appeared in Mycologia **21**: 113. 1929. Schweinitz certainly chose an appropriate name for the sclerotium of this fungus, for small rounded specimens are much like cocoanuts. Shady soil seems to suit these sclerotia best, while their hosts are many and varied. In Florida the fungus is known to be parasitic on the roots of citrus, oak, magnolia, native persimmon, and eucalyptus. In other states it has been found on sumac, pine, cedar, and even corn. The known distribution of this species is from Delaware to Florida and westward to Kansas.

2. **Poria subserpens** Murrill, comb. nov.

Trametes subserpens Murrill. *Trametes serpens* Auct. Am.

Effused, corky, villose on the margin, white or pallid, with large, unequal pores.

Abundant in Florida on various kinds of dead hardwood, ranging northward into South Carolina and southward into Brazil and Bolivia. *Poria setulosa* P. Henn., of the Philippines, resembles it. Some may place it in *Trametes*.

3. PORIA LUTEOFIBRATA Baxter, Pap. Mich. Acad. Sci. **23**: 287. 1938

Widely effused, inseparable, up to 7 mm. thick, margin tomentose, white to warm-buff, tubes 5–6 mm. long, deep-chrome, 1–2 to a mm., spores ellipsoid, 4–6.5 × 2–4 μ.

Described from Olustee, Florida, on *Pinus rigida serotina*. Similar in dried collections to *P. subacida* but its large tubes and yellow rhizomorphs distinguish it. About Gainesville the author has seen it twice, once at the base of a pine post and once on a pine log. The tubes reached 1 cm. or more in length and became luteous or orange.

4. PORIA SUBRADICULOSA Murrill, Mycol. **13**: 175. 1921

Effused, inseparable, margin very broad, white to orange-yellow, hymenium bright-orange-yellow, tubes 1–3 mm. long, 1–2 to a mm., edges becoming lacerate, spores ellipsoid, 4–5 × 2.5–3 μ.

Described from Mississippi, on pine bark, and also found at Keystone Heights, Florida, on decaying leaves and wood. It suggests *P. mollusca* when old and faded but the spores are quite different.

5. PORIA RHOADSII Murrill, Bull. Torr. Club **66**: 33. 1939

Widely effused, 3–6 mm. thick, extreme margin white, fimbriate, rest of margin flavous, tubes irregular, flavous, 3–5 mm. long, 3 to a mm., edges becoming dentate and pale-roseous, spores ellipsoid, 2 × 1 μ.

Described from Gainesville, on a sweetgum log, and found later in the vicinity.

6. PORIA FLORIDAE Murrill, Bull. Torr. Club **65**: 659. 1938

2–3 mm. thick, margin milk-white, context white, hymenium dull-white to pale-rosy-isabelline, tubes entire, 7–8 to a mm., spores globose, 3 μ.

Described from Gainesville, on a hardwood log.

7. PORIA SUBAVELLANEA Murrill, Mycol. **12**: 88. 1920

Effused in rather thin, small patches, margin milk-white, cottony, context white, hymenium glistening, pale-avellaneous, tubes entire, 1–2 mm. long, 4 to a mm., spores ovoid, 4 μ long.

Described from Auburn, Alabama, on pine bark, and also found on pine

in Arkansas. About Gainesville, the author has collected it several times on corticated logs of loblolly pine.

8. PORIA CARYAE (Schw.) Cooke, Grev. **14:** 111. 1886

Polyporus caryae Schw. *Poria gilvescens* Bres.

Widely effused, adnate, 2–4 mm. thick, margin narrow, white, fimbriate, tubes 4–5 to a mm., not stratose, umbrinous within and without in old dried specimens, mouths angular, thin-walled, cincreous in fresh specimens.

Described from Pennsylvania, on a hickory log, and collected rarely on dead wood of oak, beech, etc. from Maine to Ohio and northern Florida. Specimens collected by the author at Gainesville in 1926 agree with the type. The type of *P. cinerea* (Schw.) Cooke is not to be found, either at Philadelphia or Kew. Overholts and Lowe use *P. gilvescens* for *P. caryae.*

9. PORIA RETICULATA (Fr.) Cooke, Grev. **14:** 114. 1886

Irregularly effused, less than 0.3 mm. thick, fragile, margin cobwebby, olive-buff, tubes shallow, somewhat merulioid, 2–4 to a mm., white to olive-buff or cream-buff, spores allantoid, 6–10×2–3.5μ.

Described from Europe; frequent on hardwood in Sweden and willow in Alaska; and distributed on coniferous and frondose wood in North America southward to Florida.

10. PORIA FERRUGINICINCTA Murrill, Bull. Torr. Club **65:** 660. 1938

Widely effused, 1–1.5 cm. thick, margin ferruginous, context white, hymenium white to brownish-discolored, tubes entire, 5–6 to a mm., becoming irregular, spores globose, 5μ.

Described from Gainesville, on an oak log. White when fresh but brownish in the herbarium.

11. PORIA HETEROMORPHA Murrill, Mycol. **12:** 36. 1920

Effused, separable, 3–5 mm. thick, margin cottony, white, fulvous with age, context white to fulvous, hymenium white, ochraceous or fulvous with age, tubes large, 2–5 mm. long, 1–3 to a mm., becoming elongate and somewhat daedaleoid, spores broadly ovoid, 3–5μ long, cystidia present.

Described from Jamaica, on very rotten wood, and also collected in Porto Rico and near Ocala, Florida, on leaf-stalks of palmetto. Found recently on a palmetto trunk at Lake George, Florida. Related to *P. mollusca* but with larger tubes.

12. PORIA AMBIGUA Bres. Atti Accad. Rov. III. **3:** 84. 1897

Widely effused on the tops of logs and stumps, up to 1 cm. thick, snow-white, margin narrow, tubes 2–5 mm. long, 1–3 to a mm., spores 4–6×3–3.5μ.

Described from Europe, on *Robinia*, and common on dead hardwood in North America, especially in southern swamps from Florida westward and in woodland areas that have been burned over. Dead roots are commonly attacked, the mycelium suggesting *Sclerotinea libertiana*, while sticks or even stones in the ground may be covered by the felt-like sheets of the fungus. About Gainesville it is found on logs of oak, hornbeam, citrus, etc.

13. PORIA CUBITISPORA Murrill, Bull. Torr. Club **67**: 65. 1940

Widely effused, 5 mm. thick, margin white, context white, hymenium glistening, white, dark-isabelline where bruised, tubes entire, 3–5 mm. long, 5 to a mm., bitter, spores sharply curved, 2.5–3×1μ, cystidia abundant, projecting 30μ.

Described from Gainesville, on a much-decayed log of black gum. As bitter as quinine. *P. lenis* has spores curved in a half circle, not bent like an elbow.

14. PORIA ALACHUANA Murrill, Bull. Torr. Club **65**: 659. 1938

2–4 mm. thick, margin milk-white, context white, tubes white to lemon-yellow, entire, 4–5 to a mm., spores 3–4×2–3μ.

Described from Gainesville, on a decayed hardwood log. In older dried specimens the hymenium cracks into areas 1–2 cm. long. The species is normally annual but often revives and the tubes become stratose.

15. PORIA SUBACIDA (Pk.) Sacc. Syll. Fung. **6**: 325. 1888

Polyporus subacidus Pk. *Poria Beaumontii* (B. & C.) Cooke. *Poria subaurantia* (Berk.) Cooke *Poria ornata* (Pk.) Sacc.

Widely effused, thick, rather soft, white or cremeous to yellow, spores ovoid, 1.5×2.5–3.5μ.

Described by Peck from New York in 1885 and since collected on dead wood of various conifers and frondose trees from Labrador to Florida and Costa Rica. About Gainesville it occurs on logs of longleaf and loblolly pine.

16. PORIA VERSIPORA (Pers.) Romell, Svensk Bot. Tidsk. **20**: 15. 1926

Irpex obliquus (Schrad.) Fr. *Poria mucida* (Pers.) Fr.

Widely effused, coriaceous, 1–2.5 mm. thick, margin about 2 mm. wide, pinkish-buff, tubes 1–2 mm. long, 1–3 to a mm., cinnamon-buff, spores ellipsoid, 4.5–6×3–4μ.

Described from Europe and found in abundance on the dead wood of many frondose trees and one pine in North America southward to Florida. It is a remarkably variable species, two of the most conspicuous growth forms being designated by Romell as f. *deformis* and f. *radula*. Baxter

thinks *P. ochracea* Murrill, described from Virginia on a dead oak limb, falls within the limits of its marked variability. About Gainesville it is common on oak, hornbeam, hickory, etc. See Overholts, Genus Poria, 42. 1942.

17. PORIA VAPORARIA (Pers. ex Fr.) Cooke, Grev. **14:** 111. 1886

Effused in long patches 1–2 mm. thick, margin fimbriate, whitish, 1 mm. wide, tubes 1–2 mm. long, 1–2 to a mm., yellowish, spores cylindric or allantoid, 4–6×1–2 μ.

Common in Swedish forests on coniferous logs and occurring in Canada and the northern United States, southward to Georgia and probably to northern Florida, causing a dry, cubical, brown rot. *Poria incerta* (Pers.) Murrill is a broader interpretation of a concept much discussed both by European and American mycologists. See Mycologia for March, 1920.

18. PORIA POLYPORICOLA Murrill, Mycol. **12:** 87. 1920

Very thin, margin milk-white, discolored with age, hymenium white to pale-avellaneous-umbrinous, tubes very shallow, entire, 4–5 to a mm.

Described from Fort Myers, Florida, on an old polypore.

19. PORIA MOLLUSCA (Pers.) Cooke, Grev. **14:** 109. 1886

Effused on bark in irregular patches, white, often yellowish in age, about 1–2 mm. thick, margin 1 cm. wide, white to pale-yellow, tubes white to yellow, up to 2 mm. long, 3–4 to a mm., spores subglobose, 2.5–3μ long.

Described from Europe and interpreted by Bresadola and Romell as a soft white species which becomes yellowish with age or on drying. *P. vulgaris* Fr. and *P. arachnoidea* Murrill are related. It occurs on dead wood of both conifers and frondose trees from Alaska to Florida but few collectors recognize it.

20. PORIA CALKINSII Murrill, Mycol. **13:** 175. 1921

1–2 mm. thick, margin tomentose, isabelline in dried specimens, hymenium even, glistening, isabelline in dried specimens, tubes 1–2 mm. long, 4 to a mm., spores ellipsoid, 4×2.5μ.

Described from Florida, on dead fallen hardwood branches.

21. PORIA LENIS (Karst.) Sacc. Syll. Fung. **6:** 313. 1888

Physisporus lenis Krast. Medd. Soc. Faun. Fl. Tenn. **14:** 82. 1887.

Widely effused, up to 3 mm. thick, margin very broad, white, tubes 1–2 mm. long, 4 to a mm., white to yellow, spores curved in a half circle, 3–5× 1–2μ.

Described from Finland, on pine, and very common on coniferous wood

in North America, extending southward into northern Florida. About Gainesville the author has collected it on cypress.

22. PORIA LACTEIMICANS Murrill, Bull. Torr. Club **65:** 60. 1938

1 mm. thick, margin milk-white, context white, hymenium glistening, milk-white, slightly brownish where bruised, tubes entire, 10 to a mm., spores globose, 2μ.

Described from Gainesville, on an oak log. A dainty species with very glistening hymenium.

23. PORIA HOLOSEPARANS Murrill, Bull. Torr. Club **65:** 60. 1938

1–2 mm. thick, margin milk-white, context white, hymenium white to dirty-ochraceous, tubes entire, 10 to a mm., spores globose, 3–4μ.

Described from Gainesville, on a decayed hornbeam log.

ADDED OR DOUBTFUL SPECIES

Poria ossea Baxter, Mich. Acad. Sci. **28:** 231, 2. 1943. Described from Bayard, Florida, collected by Lloyd on bark and old wood. Near *P. mutans* Pk. and *P. spissa* (Schw.) Cooke, but yellow instead of red when dry. Spores 3–4 × 2μ. Annual and inseparable. I have not seen specimens.

Poria albostygia (B. & C.) Lloyd. Specimens collected recently by the author on a palmetto trunk in Gulf Hammock, Levy Co., were so determined by Lowe. In Berkeley & Curtis' "Cuban Fungi" this species was treated as a pileate form along with *P. adustus*. For a description see *Bjerkandera albostygia* (B. & C.) Murrill, N. Am. Fl. **9:** 41. 1907. Compare *Tinctoporia*.

2. PERENNIPORIA Murrill

Hymenophore becoming perennial, rigid; context white or yellow; tubes pinkish, white or yellow, stratose in older specimens; spores hyaline. Young hymenophores may easily be mistaken for species of *Poria*.

Hymenium white to yellow ..... 1. *P. unita*
Hymenium pinkish to gray ..... 2. *P. nigrescens*

1. PERENNIPORIA UNITA (Pers.) Murrill, Mycol. **34:** 595. 1942

Polyporus pulchellus Schw. *Polyporus alabamae* B. & Cke.
Polyporus dryinus B. & Cke. *Poria holoxantha* B. & Cke.
Poria medullapanis Pers. *Polyporus xantholoma* Schw.
Poria unita (Pers.) Karst. *Poria tomento-cincta* B. & Rav.
Poria omoema (Berk.) Cooke.

Abundant on dead wood of frondose trees in temperate and tropical America; also in Europe and Australia. Under the American Code the type of *Poria* was *P. unitus* Pers., but the International Code shifts it to *P. vul-*

garis, thus taking care of a large group of annual species but not allowing for perennials. Hence the necessity for a new genus. The "*Poria unita* Pers." of Saccardo's "Sylloge" is a *Fuscoporia*.

2. PERENNIPORIA NIGRESCENS (Bres.) Murrill, Mycol. **34:** 595. 1942

Poria nigrescens Bres. Compare *Poria undata* (Pers.) Bres.

Found on dead wood of certain conifers and frondose trees in Europe, Canada and the United States, including Florida. The pores are flesh-colored when fresh and a deep mouse-gray when dry; the spores hyaline, globose or broadly ellipsoid, 3–5μ. Found on a sweetgum log at Gainesville.

3. PHYSISPORINUS Karst.

Hymenophore effused, annual, epixylous, thin, some shade of red or purple; tubes small, thin-walled; spores smooth, hyaline.

Hymenium at length dull-red or dark-purple ..... 1. *P. spissus*
Hymenium some shade of lilac.
  Margin thin, red-tinted ..... 2. *P. carneopallens*
  Margin none ..... 3. *P. borbonica*

1. PHYSISPORINUS SPISSUS (Schw.) Murrill, Mycol. **34:** 595. 1942

Poria spissa (Schw.) Cooke. *Polyporus laetificus* Peck.

Found on dead wood of hardwoods and conifers in North America and parts of tropical America. Very few collections have been made west of the Rockies. When young it is white, then pale-salmon-tinted with a whitish border, then yellow and finally dull-red or dark-purple. The spores are hyaline and measure 4–5 × 1μ. About Gainesville it is rare on longleaf pine and cypress.

2. **Physisporinus carneopallens** (Berk.) Murrill, comb. nov.

Polyporus carneopallens Berk. Hook. Jour. Bot. **8:** 235. 1856. Poria carneopallens (Berk.) Sacc.

Described from Spruce's collections in Brazil. Found by me on an oak log in Gainesville and identified by Lowe as this species. I had confused it with *Poria vincta* (Berk.) Cooke, described from Santo Domingo.

3. **Physisporinus borbonicus** (Pat.) Murrill, comb. nov.

Poria borbonica Pat.

Described from Reunion Island and widely distributed in tropical regions on logs of mango, cocoanut, etc. According to Lowe, who identified my material, this species is common about Gainesville on logs of hickory, blackgum and several other frondose trees.

4. MERULIPORIA Murrill

Hymenophore resupinate, epixylous, effused, annual; pores merulioid, becoming purple to black with age; spores smooth, fuscous.

1. MERULIPORIA INCRASSATA (B. & C.) Murrill, Mycol. **34**: 596. 1942

Merulius incrassatus B. & C. *Poria incrassata* (B. & C.) Burt.
Merulius spissus Berk. *Polyporus pineus* Pk.

Found in buildings and lumber piles in North America on both coniferous and hardwood timber, where it does an immense amount of damage, especially in warm climates. The margin is whitish or yellowish, the hymenium dingy-white becoming purple to black with age, and the spores fuscous, 7.5–11×4–7μ. The mycelium is unusually sensitive to toxic chemicals, such as sodium fluoride. Papery sheets of mycelium are formed in the lumber attacked, causing a dry rot and cubical checking. In advanced stages the rotted timber may easily be crushed to powder between the fingers. This fungus does great damage all over Florida.

5. HYDNOPORIA Murrill

Hymenophore resupinate, annual; context thin, brown; hymenium brown, poroid, soon irpiciform or hydnoid; spores hyaline; cystidia present.

1. HYDNOPORIA FUSCESCENS (Schw.) Murrill, N. Am. Fl. **9**: 3. 1907

Hydnochaete olivaecea (Schw.) Banker. *Irpex cinnamomeus* Fr.

Common on dead hardwood from New York to Florida and westward to Wisconsin and Texas. About Gainesville oak is its usual host.

6. FUSCOPORIA Murrill

Hymenophore thin, annual; context brown; tubes brown, thin-walled, not stratified as a rule; spores hyaline.

Pores large, 1–2 to a millimeter.....1. *F. carbonaria*
Pores medium, 4 to a millimeter.....2. *F. ferruginosa*

1. FUSCOPORIA CARBONARIA (B. & C.) Murrill, N. Am. Fl. **9**: 4. 1907

Hexagonia carbonaria B. & C. *Trametes carbonaria* (B. & C.) Overh.
Trametes Sequoiae Copeland.

Occasional on charred wood of conifers in Canada and the United States, causing a brown cubical rot. It may not be a *Poria* in the strictest sense but has usually been taken for one. Overholts assigns it to *Trametes*.

2. FUSCOPORIA FERRUGINOSA (Schrad. ex. Fr.) Murrill, N. Am. Fl. **9**: 5. 1907

Poria Macouni (Pk.) Overh. *Poria ferruginosa* (Schrad. ex. Fr.) Fr.

Common on dead hardwood in North America and Europe, causing a white rot and destructive to hardwood slash in moist woods. White cedar is the only conifer it usually attacks. The hymenium often revives and forms additional tube-layers, thus simulating *Fomitiporia*. We find the same thing very often in *Hapalopilus licnoides*.

7. Fuscoporella Murrill

Hymenophore annual; context brown; tubes brown, not stratose; spores brown.

1. Fuscoporella coruscans Murrill, N. Am. Fl. **9**: 7. 1907

Described from Cuba on hardwood logs and found also in the Bahamas. Lloyd reported it from Florida but I have not seen his specimens.

8. Fomitiporia Murrill

Perennial, with brown context; tubes brown, stratose; spores hyaline; cystidia sometimes present.

Hymenophore 3–4 cm. thick ..... 1. *F. dryophila*
Hymenophore 1–2 cm. thick ..... 2. *F. langloisii*
Hymenophore less than 1 cm. thick.
  Hymenium not distinctly stratified.
    Tubes 2 mm. or less long ..... 3. *F. cryptacantha*
    Tubes considerably longer.
      Margin narrow, flavous to ferruginous ..... 4. *F. Earleae*
      Margin 1 cm. broad, isabelline to latericious ..... 5. *F. punctatiformis*
  Hymenium distinctly stratified ..... 6. *F. punctata*

1. Fomitiporia dryophila Murrill, N. Am. Fl. **9**: 8. 1907

Poria dryophila (Murrill) Sacc. & Trott.

Found on dead oak wood in Alachua and Marion Counties, Florida; also in Georgia and Mississippi.

2. Fomitiporia Langloisii Murrill, N. Am. Fl. **9**: 9. 1907

Poria Langloisii (Murrill) Sacc. & Trott.

Found on dead wood of frondose trees in Florida, South Carolina, Alabama and Louisiana.

3. **Fomitiporia cryptacantha** (Mont.) Murrill, comb. nov.

Poria cryptacantha Mont. Cent. VII, p. 37.

Found on dead hardwood in Florida and Brazil. It suggests *Pyropolyporus conchatus* but is less woody.

4. Fomitiporia Earleae Murrill, N. Am. Fl. **9**: 9. 1907

Poria Earleae (Murrill) Sacc. & Trott.

Described from Mississippi on fallen dead oak branches and collected also in Florida, Georgia and Texas. Cultures isolated from *Nyssa* and *Liquidambar* are sufficiently distinct to be classed as different "strains."

5. Fomitiporia punctatiformis Murrill, Bull. Torr. Club **65**: 659. 1938

Poria punctatiformis Murrill, Ibid. 661.

Described from Cocoa, Florida, on a fallen dead oak branch. Also collected near Gainesville, Florida, on wax myrtle.

6. **Fomitiporia punctata** (Fr.) Murrill, comb. nov.

Fomitiporia laminata Murrill. *Poria punctata* (Fr.) Karst.

Common on dead wood of a great variety of frondose trees and shrubs in Canada and the eastern United States, usually on standing rather than fallen timber. Also in Europe. Brownish deposits are found in the wood attacked by this species. They are known as decomposition products. The annual layers of tubes in the hymenophore are clearly separated by cushions of mycelium, producing a laminated effect.

9. FOMITIPORELLA Murrill

Perennial with brown context; tubes brown, stratose; spores brown.

Margin blackening with age.....1. *F. floridana*
Margin not blackening with age.....2. *F. Langloisiana*

1. FOMITIPORELLA FLORIDANA Murrill, N. Am. Fl. **9**: 14. 1907

Poria floridana (Murrill) Sacc. & Trott.

Described from specimens collected by Calkins on dead frondose wood; known also from South Carolina and Arkansas. Cultures isolated from water oak in South Carolina are typical, while those from willow oak in Arkansas agree perfectly except for the fact that they have cystidia. This may have some bearing on the value of cystidia as a taxonomic character.

2. FOMITIPORELLA LANGLOISIANA Murrill, N. Am. Fl. **9**: 13. 1907

Poria Langloisiana (Murrill) Sacc. & Trott.

Described from Louisiana, on decaying logs in swampy woods. Distinguished from *F. inermis*, a northern species, by its glistening hymenium, larger pores and the cracking of the hymenophore. In the vicinity of Gainesville it occurs on oak logs.

10. TINCTOPORIA Murrill

Hymenophore annual; mycelium often staining the substratum a deep orange-red; tubes very minute, thin-walled, black; spores hyaline.

Tinctoporia albocincta (Cooke & Mass.) Murrill occurs in the West Indies and will probably be found in material collected in southern Florida.

11. MELANOPORIA Murrill

Perennial with blackish context; tubes thin-walled, stratose, blackish; spores smooth, black; cystidia none.

1. MELANOPORIA NIGRA (Berk.) Murrill, N. Am. Fl. **9**: 15. 1907

Polyporus niger Berk. *Poria nigra* (Berk.) Cooke.

Found rarely on dead oak trunks and stumps in Florida and ranging northward on oak through nearly a dozen states to Pennsylvania and Wisconsin.

12. IRPICIPORUS Murrill

Hymenophore annual, effused-reflexed, white or pallid throughout; surface anoderm, not distinctly zonate; context white, coriaceous or corky; hymenium hydnoid or irpiciform with traces of obsolete tubes near the margin; spores hyaline.

Teeth 1 cm. or more long; pileus rather large and thick ..... 1. *I. mollis*
Teeth less than 5 mm. long; pileus thin and shortly reflexed ..... 2. *I. lacteus*

1. IRPICIPORUS MOLLIS (B. & C.) Murrill, Bull. Torr. Club **32**: 471. 1905

Irpex mollis B. & C. *Irpex crassus* B. & C.

Frequent on diseased trunks and dead wood of oak and other frondose trees in temperate North America, extending southward at least as far as DeLeon Springs, Florida.

2. IRPICIPORUS LACTEUS (Fr.) Murrill, N. Am. Fl. **9**: 15. 1907

Irpex tulipiferae (Schw.) Fr.

Abundant on dead branches and trunks of frondose trees in temperate regions of the world. Common about Gainesville on oak, hickory, etc. and collected frequently by the author in the mountains of the West Indies and eastern Mexico. Compare *Polyporus tulipiferus* (Schw.) Overh.

13. PORONIDULUS Murrill

Pileus thin, arising from a sterile, cup-like structure; context white, fibrous; spores hyaline.

1. PORONIDULUS CONCHIFER (Schw.) Murrill, Bull. Torr. Club **31**: 426. 1904

Polystictus conchifer (Schw.) Fr.

Rare in Alachua and Levy counties on dead elm branches, extending northward to Canada and westward to Kansas.

14. CORIOLUS Quél. (Polystictus)

Pileus sessile, zonate; context white, flexible; spores hyaline.

Tubes more or less entire.
Surface wholly or partly glabrous when mature or only sparsely clothed.
Pileus not entirely glabrous at maturity.
Pileus with glabrous zones of a different color.
Glabrous zones large and varicolored ..... 1. *C. versicolor*
Glabrous zones small and inconspicuous.

Hymenium white or yellowish..... 2. *C. ectypus*
Hymenium fuscous..... 3. *C. sector*
Pileus without glabrous zones, color uniform..... 4. *C. sublimitatus*
Pileus entirely glabrous at maturity.
Hymenium lilac-colored when not too old..... 5. *C. brachypus*
Hymenium white or yellowish.
Margin of pileus very thin, lacerate..... 6. *C. membranaceus*
Margin of pileus not as above..... 7. *C. subectypus*
Surface entirely and conspicuously hairy.
Pileus 5 mm. or more thick..... 8. *C. nigromarginatus*
Pileus much thinner.
Hymenium becoming fuscous.
Tubes regular in shape and size..... 9. *C. pinsitus*
Tubes irregular in shape and size..... 10. *C. sericeohirsutus*
Hymenium not becoming fuscous.
Hymenium lilac-colored; plant minute..... 11. *C. sublilacinus*
Hymenium white or nearly so.
Cystidia reddish-brown..... 12. *C. tenuispinifer*
Cystidia none.
Effused-reflexed..... 13. *C. subabietinus*
Dimidiate..... 14. *C. pavonius*
Tubes soon breaking up into long irpiciform teeth.
Plants large, 5–10 cm. broad, fibrillose-tomentose..... 15. *C. populinus*
Plants smaller and always thin.
Surface ashy-white, villose..... 16. *C. abietinus*
Surface wood-colored, tomentose..... 17. *C. prolificans*

1. CORIOLUS VERSICOLOR (L.) Quél. Ench. Fung. 175. 1886

Polyporus versicolor (L.) Fr. *Polystictus versicolor* (L.) Sacc.

Abundant and cosmopolitan on all forms of dead wood, causing a serious root-rot in many trees. Found in quantity about Gainesville and collected frequently by the author in the mountains of Mexico and the West Indies.

2. CORIOLUS ECTYPUS (B. & C.) Pat. Tax. Hymén. 94. 1900

Polyporus ectypus B. & C.

Frequent on dead wood of frondose trees from South Carolina to Florida and Louisiana.

3. CORIOLUS SECTOR (Ehrenb.) Pat. Tax. Hymén. 94. 1900

Polyporus floridanus Berk. *Poria Lindbladii* (Berk.) Cooke is a resupinate form.

Common on dead wood from South Carolina to South America. About Gainesville on logs and stumps of oak, sweet gum, etc.

4. CORIOLUS SUBLIMITATUS Murrill, Bull. Torr. Club **65**: 658. 1938

Polystictus sublimitatus Murrill, Ibid. 661.

Known only from a collection on a dead citrus trunk at Indianola, Florida.

5. CORIOLUS BRACHYPUS (Lév.) Murrill, Bull. Torr. Club **32**: 646. 1906

Polyporus brachypus Lév. *Polyporus albocervinus* Berk.

Found on dead wood from southern Florida to Brazil.

6. CORIOLUS MEMBRANACEUS (Sw.) Pat. Tax. Hymén. 94. 1900

Polyporus membranaceus Fr. *Polystictus semiplicatus* Ellis & Macbr.

Extremely common on dead wood in tropical America and occasionally found along the Gulf coast. A form occurring on cypress logs near Gainesville has been separated by the author as var. *Taxodii*. See Bull. Torr. Club **65**: 657. 1938.

7. CORIOLUS SUBECTYPUS Murrill, N. Am. Fl. **9**: 22. 1907

Polystictus subectypus (Murrill) Lloyd.

Collected on dead wood in Florida and said to occur on sweet gum in Louisiana. It may be a glabrous form of *C. ectypus*.

8. CORIOLUS NIGROMARGINATUS (Schw.) Murrill, Bull. Torr. Club **32**: 649. 1905

Polyporus hirsutus (Wulf.) Fr. *Polystictus hirsutus* (Wulf.) Sacc.

Abundant on dead wood of frondose trees in temperate regions and extending into tropical America. About Gainesville it is frequent on oak, sweet gum, hickory and elm.

9. CORIOLUS PINSITUS (Fr.) Pat. Tax. Hymén. 94. 1900

Polyporus pinsitus Fr. *Polystictus jamaicensis* P. Henn.

Common on dead wood in South America, ranging northward to Virginia, southern Michigan and Missouri. About Gainesville it occurs on cypress railway ties.

10. CORIOLUS SERICEOHIRSUTUS (Kl.) Murrill, Bull. Torr. Club **32**: 651. 1906

Polystictus barbatulus Fr.

Found usually on dead trunks and branches of red cedar from Florida to Virginia and westward to Missouri and Texas. About Gainesville it occurs also on oak.

11. CORIOLUS SUBLILACINUS Murrill, M. Am. Fl. **9**: 25. 1907

Known only from a single collection in Florida on the bark of dead branches. Too small to be noticed by the casual observer.

12. CORIOLUS TENUISPINIFER Murrill, Bull. Torr. Club **65:** 658. 1938

Polystictus tenuispinifer Murrill, Ibid. 661.

Collected once near Gainesville on a dead fallen oak branch. The spines are quite remarkable.

13. CORIOLUS SUBABIETINUS Murrill, Bull. Torr. Club **65:** 658. 1938

Polystictus subabietinus Murrill, Ibid. 661.

Found on a pine log near Gainesville. The pores are too small for *C. abietinus*.

14. CORIOLUS PAVONIUS (Hook.) Murrill, N. Am. Fl. **9:** 25. 1907

Polyporus arenicolor B. & C. *Polystictus cyclodes* Fr. *Polystictus pavonius* (Hook.) Sacc.

Found on dead logs and sticks from southern Florida to Colombia.

15. **Coriolus populinus** (Schulz.) Murrill, comb. nov.

Polyporus molliusculus Berk. *Polyporus chartaceus* Berk. *Polystictus biformis* Auct.

Common on dead wood of frondose trees, especially oak, in central Florida and northward; also in Europe. *C. biformis* (Kl.) Pat. has been generally used for this species but it is a synonym of *C. prolificans*. Bresadola uses *Trametes cervina* (Schw.) Bres. in his Icon. Mycol.

16. CORIOLUS ABIETINUS (Dicks.) Quél. Ench. Fung. 175. 1886

Polystictus abietinus (Dicks.) Sacc. & Cub.

Common on decaying coniferous trunks in the northern hemisphere. It occurs on pine about Gainesville and the author has found it to be frequent on this host in southern Florida and the mountains of Cuba and Mexico.

17. CORIOLUS BIFORMIS (Kl.) Pat. Tax. Hymén. 94. 1900

Polyporus prolificans Fries. *Polystictus pergamenus* Auct. Am.

Abundant on dead wood of frondose trees from Canada to tropical America and westward to Wisconsin and Mexico; also in Europe. About Gainesville it occurs on oak, hickory, etc., sometimes covering an entire log. The confusion of the name with that of another common species is unfortunate.

ADDED SPECIES

Coriolus maximus (Mont.) Murrill, Bull. Torr. Club **34:** 467. 1907. Described from Cuba and found on dead wood in tropical regions and southern Florida.

15. Coriolellus Murrill

Hymenophore small, annual, semi-resupinate, azonate; context white, fibrous; tubes rather large; spores hyaline.

1. Coriolellus sepium (Berk.) Murrill, Bull. Torr. Club **32**: 481. 1905

Trametes sepium Berk.

Common on structural timber and other dead wood, especially that of frondose trees, throughout temperate North America. Rare about Gainesville. *Trametes malicola* B. & C., a northern species, has a darker context.

16. Tyromyces Karst. (Polyporus)

Hymenophore sessile, anoderm, azonate; context white, fleshy to fleshy-tough, rigid and friable when dry; spores hyaline.

Pileus large, 8 cm. or more in diameter.
- Tubes less than 5 mm. long ..... 1. *T. palustris*
- Tubes more than 5 mm. long.
  - Surface very smooth.
    - Pileus white, unchanging ..... 2. *T. Calkinsii*
    - Pileus becoming dark-bay ..... 3. *T. Smallii*
  - Surface rough, becoming blackish ..... 4. *T. Spraguei*

Pileus small, rarely exceeding 5 cm. in diameter.
- Surface conspicuously villose or tomentose.
  - Pileus effused-reflexed ..... 5. *T. semipileatus*
  - Pileus not effused-reflexed.
    - Pileus bluish ..... 6. *T. caesius*
    - Pileus not bluish ..... 7. *T. pseudolacteus*
- Surface glabrous or finely hairy.
  - Pileus effused-reflexed.
    - Pileus ochraceous ..... 8. *T. Newellianus*
    - Pileus avellaneous ..... 9. *T. avellaneialbus*
    - Pileus white.
      - Pileus 5–15 mm. thick ..... 10. *T. Ellisianus*
      - Pileus 1–2 mm. thick.
        - Pileus brownish when bruised ..... 11. *T. leucomallellus*
        - Pileus unchanging ..... 12. *T. pini-glabrae*
  - Pileus not effused-reflexed.
    - Pileus 0.5–1.5 cm. thick ..... 13. *T. lacteus*
    - Pileus 2–3 cm. thick behind ..... 14. *T. magnisporus*

1. Tyromyces palustris (B. & C.) Murrill, N. Am. Fl. **9**: 31. 1907

Polyporus palustris B. & C.

Common on pine trunks and stumps from South Carolina to Florida and Louisiana, causing extensive brown heart-rot. Also in the Bahamas and Cuba.

2. Tyromyces Calkinsii Murrill, N. Am. Fl. **9**: 32. 1907

Polyporus Calkinsii (Murrill) Sacc. & Trott.

Found a few times on dead wood in Florida. About Gainesville it has been collected on live-oak and red maple.

3. TYROMYCES SMALLII Murrill, N. Am. Fl. **9:** 32. 1907

Polyporus Smallii (Murrill) Sacc. & Trott. *P. pini-ponderosae* Long.

Found a few times on pine trunks in Florida, Louisiana, and New Mexico.

4. TYROMYCES SPRAGUEI (B. &. C.) Murrill, N. Am. Fl. **9:** 33. 1907

Polyporus Spraguei B. & C. *Polyporus sordidus* Cooke.

Occasional on stumps and trunks of chestnut and oak from New England to northern Florida and westward to Iowa and Missouri. About Gainesville it is collected rarely on oak logs.

5. TYROMYCES SEMIPILEATUS (Pk.) Murrill, N. Am. Fl. **9:** 35. 1907

Polyporus semipileatus Pk.

Frequent on fallen dead branches on frondose trees from Maine to central Florida. About Gainesville it is found occasionally on oak. Compare Lloyd's *P. semisupinus.*

6. TYROMYCES CAESIUS (Schrad.) Murrill, N. Am. Fl. **9:** 34. 1907

Polyporus caesius (Schrad.) Fr. *P. caesiosimulans* Atk.

Frequent on dead wood of both frondose trees and conifers from Canada to central Florida; also in Europe. About Gainesville it is rare on oak and not as hairy as in the north. This may be a distinct variety.

7. TYROMYCES PSEUDOLACTEUS Murrill, Bull. Torr. Club **67:** 65. 1940

Polyporus pseudolacteus Murrill, Ibid. 66.

Rare on dead fallen oak branches near Gainesville, Florida.

8. TYROMYCES NEWELLIANUS Murrill, Bull. Torr. Club. **67:** 64. 1940

Polyporus Newellianus Murrill, Ibid. 66.

Found once on a rotten hardwood log in a hammock at Gainesville, Florida.

9. TYROMYCES AVELLANEIALBUS Murrill, Bull. Torr. Club **65:** 657. 1938

Polyporus avellaneialbus Murrill, Ibid. 661.

Collected but once, on a sweetgum log near Gainesville, Florida.

10. TYROMYCES ELLISIANUS Murrill, N. Am. Fl. **9**: 34. 1907

Found near Gainesville on dead fallen branches of loblolly pine; also collected on a pine log in New Jersey.

11. TYROMYCES LEUCOMALLELLUS Murrill, Bull. Torr. Club **67**: 65. 1940

Polyporus leucomallellus Murrill, Ibid. 66.

Found rarely near Gainesville on dead cypress logs.

12. TYROMYCES PINI-GLABRAE Murrill, Bull. Torr. Club **67**: 65. 1940

Polyporus pini-glabrae Murrill, Ibid. 66.

Found but once, on a dead log of spruce pine in the only beech grove in Alachua County, Florida, located near Santa Fé village.

13. TYROMYCES LACTEUS Murrill, N. Am. Fl. **9**: 36. 1907

Polyporus lacteus Auct. Am.

Frequent on dead wood of conifers and hardwood trees from Canada to central Florida and westward to Kansas; also in Europe. Collected three times near Gainesville on oak logs. Compare *P. albellus* Pk. Fries had a different plant.

14. TYROMYCES MAGNISPORUS Murrill, Bull. Torr. Club **67**: 64. 1940

Polyporus magnisporus Murrill, Ibid. 66.

Collected three times on hardwood stubs in a hammock north of Gainesville. The spores measure 10–12×5–7μ.

ADDED SPECIES

Tyromyces Tigertianus Murrill, Lloydia **6**: 228. 1943. *Polyporus Tigertianus* Murrill, Ibid. 228. Described from Penney Farms on a decayed red maple.

17. SPONGIPELLIS Pat.

Pileus usually large, white and spongy; context white; tubes white; spores hyaline.

Pileus large and thick.
Tubes large, 1 mm. or more wide ..... 1. *S. unicolor*
Tubes less than half as wide ..... 2. *S. fissilis*
Pileus small, white, becoming darker when bruised ..... 3. *S. fragilis*

1. SPONGIPELLIS UNICOLOR (Schw.) Murrill, N. Am. Fl. **9**: 37. 1907

Polyporus obtusus Berk. *Polyporus unicolor* Fr.

Frequent on diseased trunks of oak, maple, etc. from New Jersey to Florida and westward to Minnesota and Mississippi.

2. SPONGIPELLIS FISSILIS (B. & C.) Murrill, N. Am. Fl. **9:** 39. 1907

Polyporus fissilis B. & C.

Rather common on dead or diseased trunks of frondose trees from North Carolina to southern Florida and Louisiana. About Gainesville it causes a serious heart-rot in hickory, sweet gum and several species of oak.

3. SPONGIPELLIS FRAGILIS (Fr.) Murrill, N. Am. Fl. **9:** 39. 1907

Polyporus fragilis Fr. *Polyporus mollis* Fr.

Occasional on dead coniferous wood in the eastern United States, southward to Alachua County, Florida, where it is rare on old pine logs. Resupinate forms are distinguished with difficulty from *Poria albobrunnea* (Romell) Baxter, from which *Poria dichroa* Bres. is not distinct.

18. BJERKANDERA Karst.

Context white, not friable when dry; hymenium smoke-colored; spores hyaline.

1. BJERKANDERA ADUSTA (Willd.) Karst. Medd. Soc. Faun. Fl. Fenn. **5:** 38. 1879

Polyporus adustus Fr.

Cosmopolitan on dead hardwood and occurring at times on coniferous wood.

19. TRAMETES Fr.

Pileus sessile, anoderm, azonate; context white, firm or punky; spores hyaline.

Context punky, soft.
- Surface partly brown or red, especially behind.
  - Found in southern Florida ..... 1. *T. cubensis*
  - Found in northern Florida ..... 2. *T. amygdalina*
- Surface entirely white or cremeous ..... 3. *T. subcubensis*

Context fibrous-corky, firm.
- Pores 2 to a millimeter ..... 4. *T. Humeana*
- Pores 6 to a millimeter ..... 5. *T. subnivosa*

1. TRAMETES CUBENSIS (Mont.) Sacc. Syll. Fung. **9:** 198. 1891

Polyporus cubensis Mont.

Found on dead wood in southern Florida, the West Indies and Central America.

2. TRAMETES AMYGDALINA (Berk. & Rav.) Murrill, Mycol. **15:** 279. 1923

Polyporus amygdalinus Berk. & Rav. Compare *P. pseudosulphureus* Long.

Occasional on old oak logs and stumps in South Carolina, Florida and Alabama. About Gainesville it is frequent, and it has also been collected in

adjoining counties and Hernando. The superficial resemblance to *Laetiporus sulphureus* is very striking. Long's species, found by him three times in Florida, can hardly be distinct. I have not seen his material.

3. TRAMETES SUBCUBENSIS Murrill, Bull. Torr. Club **65:** 656. 1938

Polyporus subcubensis Murrill, Ibid. 661.

Known only from Alachua, Clay and Levy Counties, Florida, where it has been collected on old logs of oak, sweet gum and red bay.

4. TRAMETES HUMEANA Murrill, Bull. Torr. Club **65:** 656. 1938

Polyporus Humeanus Murrill, Ibid. 661.

Known only from Alachua County, Florida, where it has been found on old logs of oak and sweet bay.

5. TRAMETES SUBNIVOSA Murrill, N. Am. Fl. **9:** 43. 1907

Polyporus subnivosus (Murrill) Sacc.

Occasional on dead wood of frondose trees in Florida, Mississippi and Louisiana. At New Orleans it was collected on living water oak and at Eustis, Florida, on cypress.

20. RIGIDOPORUS Murrill

Pileus multizonate; context thin, white, very rigid when dry; tubes minute, pallid, rigid; spores hyaline.

1. RIGIDOPORUS SURINAMENSIS (Miq.) Murrill, Bull. Torr. Club **34:** 473. 1907

Polyporus zonalis Berk. *Polyporus surinamensis* Miq.

Found on water-soaked logs of broad-leaved trees in tropical America and the warmer portions of the Gulf States. In Florida one finds it on oak, ash, magnolia, grapefruit, palmetto and occasionally on pine. An unusually large form occurring about Gainesville is considered a variety. It causes a butt-rot in living oak. See Lloydia **5:** 156. 1942.

21. HEXAGONA (Pollini) Murrill

Context thin, white, flexible; hymenium of radiating rows of large hexagonal tubes, usually radically elongate; spores white; stipe usually lateral, sometimes much reduced.

Tubes equally hexagonal ..... 1. *H. cucullata*
Tubes unequally hexagonal, the radial walls longer.
  Surface of pileus distinctly tomentose ..... 2. *H. reniformis*
  Surface of pileus not distinctly tomentose.
    Pileus reniform at maturity ..... 3. *H. alveolaris*
    Pileus flabelliform.
      Pileus 3 cm. or less in diameter ..... 4. *H. floridana*
      Pileus 4 cm. or more in diameter ..... 5. *H. daedalea*

1. HEXAGONA CUCULLATA (Mont.) Murrill, Bull. Torr. Club **31:** 332. 1904

Favolus cucullatus Mont.

Frequent about Gainesville on hardwood and extending southward into tropical America.

2. HEXAGONA RENIFORMIS Murrill, N. Am. Fl. **9:** 50. 1907

Favolus reniformis (Murr.) Sacc. & Trott.

Rare on hardwood in southern Florida.

3. HEXAGONA ALVEOLARIS (DC.) Murrill, Bull. Torr. Club **31:** 327. 1904

Favolus canadensis Kl. *Favolus alveolaris* (DC.) Quél.

Rare on dead wood of oak, elm and hornbeam in Alachua and Levy Counties, becoming more abundant northward.

4. HEXAGONA FLORIDANA Murrill, Bull. Torr. Club **31:** 330, 1904

Rare on logs in rich woods in southern Florida.

5. HEXAGONA DAEDALEA (Link) Murrill, Bull. Torr. Club **31:** 328. 1904

Favolus brasiliensis Fr.

Abundant on hardwood logs about Gainesville and southward to tropical America.

22. MICROPORELLUS Murrill

Pileus multizonate; context white; tubes very minute; spores hyaline.

Stipe central, pileus thickish ..... 1. *M. dealbatus*
Stipe lateral, pileus thin ..... 2. *M. mutabilis*

1. MICROPORELLUS DEALBATUS (B. & C.) Murrill, Bull. Torr. Club **32:** 483. 1905

Polyporus dealbatus B. & C.

Frequent on dead buried roots of hardwood trees in Alachua County and extending northward into Kentucky and Missouri. See Bull. Torr. Club **65:** 649. 1938.

2. MICROPORELLUS MUTABILIS (B. &. C.) Murrill, Bull. Torr. Club **65:** 649. 1938

Polyporus mutabilis B. & C.

Common on dead wood of magnolia, sweet gum, oak, black gum, hornbeam, etc. in Alachua and Levy Counties and extending southward into tropical America.

23. Polyporus (Micheli) Fr.

Hymenophore annual, stipitate; context pallid; spores hyaline.

Pileus 1–2.5 cm. broad; margin ciliate ..... 1. *P. arcularius*
Pileus 4–6 cm. broad; margin not ciliate ..... 2. *P. Arnoldae*
Pileus 6–8 cm. broad; surface ochraceous ..... 3. *P. Rhoadsii*
Pileus 8–20 cm. broad; surface umbrinous ..... 4. *P. Westii*

1. Polyporus arcularius (Batsch) Fr. Syst. Myc. **1:** 342. 1821

Common on dead wood of various trees from Connecticut to the West Indies and westward to Colorado and Mexico. In Florida one finds it abundant on buried wood and branches of hickory, citrus, palmetto, etc. *Boletus alveolarius* Bosc. is this species.

2. Polyporus Arnoldae Murrill, Bull. Torr. Club **65:** 653. 1938

Type collected on a hardwood log in a hammock near Gainesville. Also found by the author on a dead oak branch in Gainesville.

3. Polyporus Rhoadsii Murrill, Bull. Torr. Club **65:** 653. 1938

Common about Gainesville on old logs of oak, sweet gum and red bay, and occasionally on pine. Also found in Clay and Levy Counties. A near relative of *P. virgatus*, a Cuban species.

4. Polyporus Westii Murrill, Bull. Torr. Club **65:** 651. 1938

Collected twice near Gainesville, once on a sweetgum log and once on a magnolia log not many steps distant.

Added Species

Polyporus Gratzianus Murrill, Jour. Fla. Acad. Sci. **8:** no. 2. 197. 1945. Described from Alachua County, Florida, on dead buried oak roots. Also collected in the county on dead sweetgum roots.

Polyporus gracilis Kl. was reported by Singer from southern Florida on rotten hardwood logs in Lloydia **8:** 216. 1945. See *Filoboletus*.

24. Abortiporus Murrill

Hymenophore annual, stipitate, often aborted; context pallid, duplex; spores hyaline.

Surface of pileus tomentose; spores smooth ..... 1. *A. distortus*
Surface of pileus shaggy; spores rough ..... 2. *A. subabortivus*

1. ABORTIPORUS DISTORTUS (Schw.) Murrill, Bull. Torr. Club **31:** 422. 1904

Polyporus abortivus Pk. *Polyporus distortus* (Schw.) Fr.

Frequent about stumps and old roots of frondose trees in Canada and the United States as far west as Wisconsin and Texas. About Gainesville one finds it mostly near oak stumps. No specimens have been seen by me south of Gainesville.

2. ABORTIPORUS SUBABORTIVUS Murrill, Bull. Torr. Club **65:** 655. 1938

Polyporus subabortivus Murrill, Ibid. 661.

Collected twice northwest of Gainesville, Florida, growing from dead buried roots in a hammock. The species is related to *Daedalea philippinensis* Pat., but distinct.

25. SCUTIGER (Paulet) Murrill

Hymenophore simple, annual, mesopous; context fleshy to tough; spores hyaline.

Growing on the base of oak trunks.....1. *S. persicinus*
Growing in soil in woods.....2. *S. subrubescens*
Growing on shaded leaf-mulch.....3. *S. Tisdalei*

1. SCUTIGER PERSICINUS (B. & C.) Murrill, Bull. Torr. Club **30:** 431. 1903

Polyporus persicinus B. & C.

Rare at the base of trunks from North Carolina to Florida and westward to Louisiana, doubtless causing a butt-rot. About Gainesville it occurs only on living live-oak.

2. SCUTIGER SUBRUBESCENS Murrill, Bull. Torr. Club **67:** 277. 1904
Polyporus subrubescens Murrill, comb. nov.

Frequent in moist oak woods about Gainesville, Florida. Also collected in Columbia County.

3. SCUTIGER TISDALEI Murrill, Lloydia **6:** 227. 1943

Polyporus Tisdalei Murrill, Ibid. 228.

Described from Gainesville, Fla., on shaded leaf-mulch.

26. GRIFOLA (Micheli) S. F. Gray

Hymenophore compound, stipitate; context white; spores hyaline.

Hymenium white or pallid.....1. *G. ramosissima*
Hymenium fuliginous to paler.....2. *G. mesenterica*
Hymenium ochraceous to dirty-yellow.....3. *G. cristata*

1. GRIFOLA RAMOSISSIMA (Scop.) Murrill, Bull. Torr. Club **31**: 336. 1904

Polyporus umbellatus (Pers.) Fr.

Rare in Alachua County at the base of hardwood trunks or stumps, extending northward to Connecticut and Ohio; also in Europe.

2. GRIFOLA MESENTERICA (Schaeff.) Murrill, Mycol. **12**: 10. 1920

Polyporus giganteus (Pers.) Fr. *Grifola Sumstinei* Murrill.

Found on the buried roots of a southern hackberry near Gainesville; frequent about old stumps and trunks of frondose trees in Louisiana and northward to Ohio and New York; also in Europe.

3. GRIFOLA CRISTATA (Pers.) S. F. Gray

Polyporus cristatus (Pers.) Fr. *Grifola flavovirens* (Berk. & Rav.) Murrill.

Found growing from a buried root near Gainesville, Florida, and frequent on the ground in frondose woods in the eastern United States as far westward as Missouri; also in Europe. Young hymenophores may easily be assigned to *Scutiger* by mistake.

ADDED SPECIES

Grifola cristatiformis Murrill, Lloydia **6**: 227. 1943. *Polyporus cristatiformis* Murrill, Ibid. 228. Described from near Gainesville, Fla., in red-oak woods and frequent in the vicinity in leaf-mold under frondose trees.

27. PYCNOPORUS Karst.

Pileus anoderm, red; context red; tubes red; spores hyaline.

Pileus thick, smooth, opaque.....1. *P. cinnabarinus*
Pileus thin, often zonate, brilliant-red.....2. *P. sanguineus*

1. PYCNOPORUS CINNABARINUS (Jacq.) Karst. Rev. Myc. **39**: 18. 1891

Polyporus cinnabarinus (Jacq.) Fr. *Trametes cinnabarina* (Jacq.) Fr.

Found in temperate regions on dead wood of various frondose trees. In Alachua County it occurs frequently on logs of oak, wild cherry, etc.

2. PYCNOPORUS SANGUINEUS (L.) Murrill, Bull. Torr. Club **31**: 421. 1904

Polystictus sanguineus (L.) Fr.

Found on dead wood of various frondose and evergreen trees in tropical regions of the world and extending northward in the United States to Virginia and Tennessee. In Alachua County one finds it common on oak, sweet gum, wax myrtle, pine, etc. Specimens in bright sunlight may bleach to pure-white.

28. Aurantiporus Murrill

Context reddish-yellow, subwoody; tubes orange; spores hyaline.

1. Aurantiporus croceus (Pers.) Murrill, Mycol. 12: 11. 1920

Polyporus pilotae Schw. *Polyporus croceus* (Pers.) Fr.

Rare on diseased oak trunks and logs in Alachua, Levy, Putnam and Clay Counties, extending northward into North Carolina and New York.

29. Laetiporus Murrill

Context cheesy to fragile, light-colored; tubes bright-yellow; spores hyaline.

1. Laetiporus sulphureus (Bull.) Murrill, Mycol. 12: 11. 1920

Polyporus sulphureus (Bull.) Fr. *Laetiporus speciosus* (Batt.) Murr.

Cosmopolitan on trunks on frondose and rarely coniferous trees, causing a very serious heart-rot. In Florida it occurs chiefly on oak and occasionally on red bay. The author formerly used the oldest name, *A. speciosus*, for this species but it was later decided that Battarra was a non-binomial writer.

30. Cerrenella Murrill

Pileus thin, brown, zonate; context brown, coriaceous; hymenium poroid, becoming irpiciform; spores hyaline.

Hymenium ferruginous, unchanging ..... 1. *C. Ravenelii*
Hymenium olivaceous, becoming cinereous ..... 2. *C. farinacea*

1. Cerrenella Ravenelii (Berk.) Murrill, N. Am. Fl. 9: 73. 1908

Irpex tabacinus B. & C.

Common on dead fallen oak branches in Alachua County and northward. Also collected at New Smyrna and in Royal Palm Hammock.

2. Cerrenella farinacea (Fr.) Murrill, N. Am. Fl. 9: 74. 1908

Irpex farinaceus Fr.

Common on dead branches of hardwood trees in tropical America and northward to Ohio and Iowa. Oak is a common host.

31. Coriolopsis Murrill

Pileus annual, zonate, hairy; context thin, usually yellowish-brown; spores hyaline.

Pores inconspicuous, pileus soft and flexible ..... 1. *C. crocata*
Pores conspicuous.
  Pores large, 1–2 to a millimeter ..... 2. *C. Tisdaleana*
  Pores medium, 3–4 to a millimeter.
    Pileus thick and large ..... 3. *C. occidentalis*
    Pileus thin.
      Hymenium pallid to isabelline ..... 4. *C. rigida*
      Hymenium murinous to umbrinous ..... 5. *C. fulvocinerea*

1. Coriolopsis crocata (Fr.) Murrill, Bull. Torr. Club **32:** 358. 1905

Polyporus crocatus Fr. *Polyporus byrsinus* Mont.

Frequent on old oak logs about Gainesville and extending into tropical America, where it is quite common on dead wood of broad-leaved trees.

2. Coriolopsis Tisdaleana Murrill, Bull. Torr. Club **65:** 656. 1938

Polyporus Tisdaleanus Murrill, Ibid. 656.

Known only from specimens collected near Gainesville, Florida, on a dead hardwood log.

3. Coriolopsis occidentalis (Kl.) Murrill, Bull. Torr. Club **32:** 358. 1905

Polyporus occidentalis Kl.

Abundant on various kinds of dead wood in tropical regions. It has been collected a few times on citrus in central peninsular Florida.

4. Coriolopsis rigida (Berk. & Mont.) Murrill, N. Am. Fl. **9:** 75. 1908

Trametes rigida Berk. & Mont. *Polystictus extensus* Cooke.

Common on dead wood of frondose trees in tropical America and extending northward to Pennsylvania and Missouri. About Gainesville one finds it on oak, hickory, ash, etc.

5. Coriolopsis fulvocinerea Murrill, N. Am. Fl. **9:** 76. 1908

Polyporus fulvocinereus (Murrill).

Found on dead wood in the West Indies and collected once on a dead orange branch at Vero Beach, Florida.

32. FUNALIA Pat.

Pileus hairy; context light-brown; spores hyaline.

1. FUNALIA VERSATILIS (Berk.) Murrill, S. Pol. **33:** 1915

Trametes versatilis Berk.

Rare on dead cypress wood in Alachua County; frequent on both hardwood and coniferous wood in southern Florida and Louisiana; common in the Tropics of both hemispheres.

33. HAPALOPILUS KARST.

Pileus anoderm, sessile; context yellowish-brown; tubes small; spores hyaline.

Hymenium concolorous; context soft.
- Tubes 3 to a millimeter ..... 1. *H. rutilans*
- Tubes 6 to a millimeter ..... 2. *H. subrutilans*

Hymenium differently colored; context firm.
- Pileus azonate ..... 3. *H. gilvus*
- Pileus distinctly multizonate ..... 4. *H. licnoides*

1. HAPALOPILUS RUTILANS (Pers.) Murrill, Bull. Torr. Club **31:** 416. 1904

Polyporus nidulans Fr. *Polyporus rutilans* (Pers.) Fr.

Found occasionally on dead wood of hickory and certain other deciduous trees in temperate North America; also in Europe. Very rare on hickory logs about Gainesville.

2. HAPALOPILUS SUBRUTILANS Murrill, Bull. Torr. Club **65:** 655. 1938

Polyporus subrutilans Murrill, Ibid. 661.

Known only from Hatchet Creek, near Gainesville, on a fallen dead branch of *Magnolia virginiana.*

3. HAPALOPILUS GILVUS (Schw.) Murrill, Bull. Torr. Club. **31:** 418. 1904

Polyporus gilvus (Schw.) Fr.

Cosmopolitan and abundant on dead wood of frondose trees. About Gainesville it occurs on oak, orange, privet, pine, cypress, etc.

4. HAPALOPILUS LICNOIDES (Mont.) Murrill, Bull. Torr. Club **31:** 417. 1904

Polyporus licnoides Mont. *Polystictus licnoides* Fr.

Found commonly on dead wood in tropical regions and the Gulf States.

In Florida its hosts are oak, red bay, chinaberry, etc. Often it revives to form thick masses resembling certain species of Pyropolyporus.

34. Pogonomyces Murrill (Polyporus)

Surface covered with rigid hairs; context dark-brown; spores hyaline.

1. Pogonomyces hydnoides (Sw.) Murrill, Bull. Torr. Club **31**: 609. 1904

Common in the Gulf States and tropical America on various forms of dead wood. In Alachua County it occurs chiefly on oak logs. *Trametes gilvoides* C. G. Lloyd, described from Florida on oak, may not be distinct. I have not seen a specimen.

35. Nigroporus Murrill

Pileus annual, glabrous; context dark-brown; tubes black; spores hyaline.

1. Nigroporus vinosus (Berk.) Murrill, Bull. Torr. Club **32**: 361. 1905

Polyporus vinosus Berk.

Found rarely on dead wood in Georgia, Alabama, Louisiana, Florida and tropical America. In Alachua County it is surprisingly common on oak, black gum and pine logs.

36. Cycloporellus Murrill

Context thin, fibrous, brown; tubes often becoming concentrically elongate; spores pale-ferruginous.

1. Cycloporellus iodinus (Mont.) Murrill, N. Am. Fl. **9**: 85. 1908

Polyporus iodinus Mont.

Frequent on decayed oak wood in Alachua and Levy Counties, extending southward into tropical America.

37. Inonotus Karst. (Polyporus)

Hymenophore annual, sessile; context brown; spores some shade of brown.

Hymenophore large, 10–30 cm. or more broad.
- Surface conspicuously hirsute ..... 1. *I. hirsutus*
- Surface velvety-scrupose ..... 2. *I. ludovicianus*

Hymenophore small, 2–5 cm. broad.
- Pores minute, 8 to a millimeter ..... 3. *I. corrosus*
- Pores larger, 2–4 to a millimeter ..... 4. *I. amplectens*

1. Inonotus hirsutus (Scop.) Murrill, Bull. Torr. Club **31**: 594. 1904

Polyporus hispidus (Bull.) Fr. *Polyporus Bankeri* Lloyd.

Occasional on living trunks on frondose trees in the eastern United States, causing a serious canker and heart-rot. In Europe it is abundant on shade trees and very destructive. In Florida it ranges southward to Brevard County, at least, occurring only on species of oak. So far it has not become abundant enough to be serious but it should be watched.

2. INONOTUS LUDOVICIANUS (Pat.) Murrill, S. Pol. 41. 1915.

Polyporus ludovicianus (Pat.) Sacc. & Trott.

Frequent on living trunks of frondose trees, especially oak, from South Carolina to central Florida and westward to Louisiana, causing an extensive butt-rot. About Gainesville it is common on laurel oak and water oak, rare on live-oak and red maple. My var. *melleus* was found on laurel oak.

3. INONOTUS CORROSUS Murrill, Bull. Torr. Club **31**: 598. 1904

Polyporus corrosus (Murr.) Sacc. & Trott.

Found on decayed vines and trunks in southern Florida and the West Indies.

4. INONOTUS AMPLECTENS Murrill, Bull. Torr. Club **31**: 600. 1904

Polyporus amplectens (Murr.) Sacc. & Trott.

Common on living twigs of the dwarf pawpaw in Florida as far south as Brevard County, at least, and collected once in Georgia on the same host. All species of the pawpaw are attacked but no other shrubs. A closely related Cuban species, *I. frulicum* (B. & C.) Murrill, grows on orange and oleander twigs. If the Florida fungus were the same as the Cuban it would surely appear on orange and oleander in Florida, where there is abundant opportunity. The two species of fungi are so much alike that the author not only examined the Curtis types at Kew very carefully himself but also had their hosts examined microscopically. There are no dwarf pawpaws in Cuba. Either a common ancestor explains the close resemblance of the two fungi or the Florida species is descended from the Cuban.

ADDED SPECIES

INONOTUS PERPLEXUS (Pk.) Murrill, N. Am. Fl. **9**: 88. 1908.

Polyporus perplexus Pk. *P. cuticularis* (Bull.) Fr. *Inonotus cuticularis* (Bull.) Karst.

Collected inside a hollow stump of laurel oak at Gainesville.

38. PHAEOLUS Pat.

Surface hispid; context ferruginous; spores hyaline.

1. PHAEOLUS SISTOTREMOIDES (Alb. & Schw.) Murrill, Bull. Torr. Club **32**: 363. 1905

Polyporus Schweinitzii Fr.

Common on trunks, stumps and roots of various conifers, especially pine, in temperate regions and extending southward to St. Augustine. It causes a very serious reddish-brown rot of the roots and lower parts of the trunk in infected coniferous trees.

39. COLTRICIELLA Murrill

Stipe attached to the vertex of the pileus; context ferruginous; spores ferruginous.

1. COLTRICIELLA DEPENDENS (B. & C.) Murrill, Bull. Torr. Club. **31**: 348. 1904

Polyporus dependens B. & C. *Polystictus dependens* (B. & C.) Sacc.

Found on a red cedar stump in Alachua County; rare northward to New Jersey and Long Island on decorticated pine wood.

40. COLTRICIA (Micheli) S. F. Gray

Hymenophore annual, usually central-stemmed; context yellowish or brown; spores yellowish-brown.

Pileus not distinctly zoned, tomentose ..... 1. *C. tomentosa*
Pileus distinctly zoned, thin, often shining.
  Growing in hollow trunks of red bay ..... 2. *C. Mowryana*
  Growing on the ground.
    Pileus shining-cinnamon ..... 3. *C. cinnamomea*
    Pileus dull-rusty-cinnamon to hoary.
      Tubes small, 0.5 mm. or less wide ..... 4. *C. perennis*
      Tubes large, 1 mm. wide ..... 5. *C. focicola*

1. COLTRICIA TOMENTOSA (Fr.) Murrill, Bull. Torr. Club **31**: 346. 1904

Polyporus tomentosus Fr. *Polyporus circinatus* Fr.

Common in North America on dead wood of conifers; also in Europe. Found rarely in Alachua and Clay Counties on pine. Specimens I have seen in Florida belong to Peck's var. *dualis* with curved setae.

2. COLTRICIA MOWRYANA Murrill, Bull. Torr. Club **67**: 228. 1940

Polystictus Mowryanus Murrill, Ibid. 235.

Common in Alachua and Clay Counties in hollow trunks of living red bay.

3. COLTRICIA CINNAMOMEA (Jacq.) Murrill, Bull. Torr. Club **31**: 343. 1904

Polystictus cinnamomeus (Jacq.) Sacc. *Polyporus splendens* Pk.

Cosmopolitan on mossy soil or much-decayed wood. It is common in certain parts of Florida.

4. COLTRICIA PERENNIS (L.) Murrill, Jour. Myc. **9:** 91. 1903

Polystictus perennis (L.) Karst.

Found on dry exposed soil in woods in north temperate regions; extending southward in the United States to central Florida, where it is rarely seen.

5. COLTRICIA FOCICOLA (B. & C.) Murrill, N. Am. Fl. **9:** 92. 1908

Polyporus focicola B. & C. *Polystictus focicola* (B. & C.).

Frequent to common on burnt soil in woods from Connecticut to central Florida.

41. FOMES Gill.

Context white or flesh-colored; tubes usually stratose; spores hyaline or subhyaline.

Context flesh-colored ..... 1. *F. subroseus*
Context white or pallid.
  Pileus less than 3 cm. broad.
    Pileus ungulate, black at the base ..... 2. *F. ohiensis*
    Pileus scutellate, entirely black ..... 3. *F. scutellatus*
  Pileus more than 3 cm. broad.
    Pileus encrusted, zonate ..... 4. *F. annosus*
    Pileus not encrusted, azonate.
      Pileus 10–20 cm. broad ..... 5. *F. geotropus*
      Pileus 5–10 cm. broad ..... 6. *F. populinus*

1. FOMES SUBROSEUS (Weir) Overh. Pol. Pa. 11. 1935

Trametes carnea Auct. Am. *Trametes subrosea* Weir.

Rare about Gainesville on cypress, pine and red cedar; more common northward, on dead wood of conifers.

2. FOMES OHIENSIS (Berk.) Murrill, Bull. Torr. Club **30:** 230. 1903

Ganoderma ohiense (Berk.) Coker. *Trametes ohiensis* Berk.

Rare about Gainesville on dead wood of oak, hornbeam and red bay; found northward on dead wood of deciduous trees, especially beech and black locust.

3. FOMES SCUTELLATUS (Schw.) Cooke, Grev. **14:** 19. 1885

Rare in Florida and frequent northward on dead branches of alder, witch hazel and other deciduous trees and shrubs.

4. Fomes annosus (Fr.) Cooke, Grev. **14:** 20, 1885

Frequent on pine logs, stumps and roots in Alachua and Clay counties; more common northward on trunks and roots of various conifers, rarely on hardwoods, causing serious decay.

5. Fomes geotropus Cooke, Grev. **13:** 119. 1884

Rare in Alachua and Duval counties on logs or diseased trunks of magnolia, elm, laurel oak, hackberry, sweet gum, box elder, black gum, linden, red bay and cypress, causing a serious rot; extending southward into South America.

6. Fomes populinus (Schum.) Cooke, Grev. **14:** 20. 1885

Fomes connatus (Weinm.) Gill.

Rare in Florida but more common northward on living trunks of maple and certain other deciduous trees, causing decay. Donk founded his genus *Oxyporus* on this species.

Added Species

Fomes fraxineus (Bull.) Cooke, Grev. **14:** 21. 1885. Described from France and found on trunks and stumps on frondose trees in Europe and the eastern United States. I have collected it at Gainesville on a diseased laurel oak and a log of the southern hackberry; and near Orange Springs on a diseased trunk of our common willow. It was listed for the state by Overholts.

Fomes Sagraeanus (Mont.) Murrill, N. Am. Fl. **9:** 96. 1908. Described from Cuba and found on dead logs and stumps in southern Florida, Bermuda and Colombia.

42. Fomitella Murrill (Fomes)

Context brownish-olivaceous; tubes more or less stratose; spores hyaline.

1. Fomitella supina (Sw.) Murrill, Bull. Torr. Club **32:** 365. 1905

Fomes supinus (Sw.).

Common on hardwood in most of the southern states at low elevations. About Gainesville it occurs on hickory, red bay and several species of oak.

43. Pyropolyporus Murrill (Fomes)

Phellinus Quél. 1886. Not *Phelline* Poir. 1826.

Context brown; tubes stratose; spores hyaline.

Pileus ungulate.....1. *P. Calkinsii*
Pileus applanate.
On cypress in northern Florida.....2. *P. taxodii*
On other dead trees in southern Florida.....3. *P. extensus*

1. PYROPOLYPORUS CALKINSII Murrill, Bull. Torr. Club **30:** 113. 1903

Fomes Calkinsii (Murr.) Sacc. & D. Sacc.

Frequent on living trunks of oak in Florida, Georgia, North Carolina, Mississippi and Louisiana, causing heart-rot.

2. PYROPOLYPORUS TAXODII Murrill, Bull. Torr. Club **65:** 651. 1938

Fomes taxodii Murrill, Ibid. 661.

Very rare on dead pond cypress in Alachua County.

3. PYROPOLYPORUS EXTENSUS (Lév.) Murrill, N. Am. Fl. **9:** 110. 1908

Fomes extensus (Lév.).

Rare on decayed trunks in southern Florida and tropical America.

ADDED SPECIES

Pyropolyporus dependens Murrill, N. Am. Fl. **9:** 106. 1908. *Fomes dependens* (Murr.) Sacc. & Trott. Described from Cuba on hardwood trunks and also found in the Bahamas and southern Florida.

Pyropolyporus fulvus (Scop.) Murrill, Bull. Torr. Club **30:** 112. 1903. *Fomes fulvus* (Scop.) Gill. Described from Carniola and found on diseased trunks and stumps of various species of *Prunus* in Europe and temperate North America. Overholts in 1939 included Florida in its distribution but it is rare in the state. Lowe uses the name *Fomes pomaceus* (Pers.) Lloyd.

44. FULVIFOMES Murrill (Fomes)

Context brown or dark-red; tubes stratose; spores ferruginous or fulvous.

1. **Fulvifomes Demidoffii** (Lév.) Murrill, comb. nov.

Fomes juniperinus (Schrenk) Sacc. & Syd.

Found once on a southern red cedar near Gainesville and occasionally collected on *Juniperus* in Tennessee, Pennsylvania, Kentucky, Texas, New Mexico and Russia.

45. PORODAEDALEA Murrill

Context brown; woody, hymenium varying from porose to daedaleoid; spores hyaline at maturity, brownish with age; cystidia conspicuous.

1. PORODAEDALEA PINI (Thore) Murrill, Bull. Torr. Club **32**: 367. 1905

Fomes pini (Thore) Lloyd. *Trametes pini* (Thore) Fr.

Rare in Florida but common on trunks of living conifers in most temperate regions, causing a very serious heart-rot.

46. NIGROFOMES Murrill (Fomes)

Context woody, purple; tubes stratose, black; spores smooth, hyaline.

1. NIGROFOMES MELANOPORUS (Mont.) Murrill, Bull. Torr. Club **31**: 425. 1904

Fomes melanoporus (Mont.) Sacc.

Rare on trunks of trees in southern Florida, extending into tropical America and tropical Asia.

47. ELFVINGIELLA Murrill (Fomes)

Context brown, punky; tubes stratose; spores smooth, hyaline or subhyaline.

1. ELFVINGIELLA MARMORATA (B. & C.) Murrill, Mycol. **12**: 14. 1920

Fomes marmoratus (B. & C.) Sacc.

Very common about Gainesville on diseased trunks and logs of oak, orange and other hardwood trees; extending into the other Gulf states and tropical America. See *Elfvingia fasciata* Murrill, N. Am. Fl. **9**: 114. 1908.

48. ELFVINGIA Karst (Fomes)

Context brown, punky; tubes stratose; spores rough, brown.

1. ELFVINGIA TORNATA (Pers.) Murrill, Bull. Torr. Club **30**: 301. 1903

Fomes australis (Pers.) Cooke. *Fomes tornatus* (Pers.)

Common in Alachua and Clay Counties on diseased or dead trunks of oak, ash, hickory, holly, magnolia, persimmon, red maple and orange; extending southward into tropical America; also in tropical Asia.

49. GANODERMA Karst.

Surface varnished; context punky; spores brown.

On palms ..... 1. *G. zonatum*
On hardwoods.
Margin of pileus truncate at maturity ..... 2. *G. Curtisii*
Margin of pileus acute at maturity ..... 3. *G. pseudoboletus*

1. GANODERMA ZONATUM Murrill, Bull. Torr. Club **29:** 606. 1902

Ganoderma sulcatum Murrill.

Common on trunks and logs of palmetto and certain other palms from Duval and Alachua Counties southward, often causing heart-rot.

2. GANODERMA CURTISII (Berk.) Murrill, N. Am. Fl. **9:** 120. 1908

Common on trunks and stumps of oak, sweet gum and certain other frondose trees, often causing serious decay. From central Florida it ranges northward to New York and westward to Texas.

3. GANODERMA PSEUDOBOLETUS (Jacq.) Murrill, Mycol. **12:** 15. 1920

Ganoderma sessile Murrill. *Polyporus lucidus* (Leyss.) Fr. *Ganoderma lucidum* (Leyss.) Karst.

Frequent on trunks of various hardwood trees, such as oak and maple, from New England to central Florida and westward, causing extensive heart-rot. Also in Europe.

ADDED SPECIES

Ganoderma subincrustatum Murrill, N. Am. Fl. **9:** 122. 1908. Described from Jamaica on a logwood stump and also collected in British Honduras and southern Florida.

Ganoderma subtuberculosum Murrill, Lloydia **7:** 326. 1944. Described from Palm Beach County, Florida, on *Casuarina*.

50. CERRENA (Micheli) S. F. Gray

Context white, flexible; hymenium labyrinthiform, usually becoming irpiciform; spores hyaline.

1. CERRENA UNICOLOR (Bull.) Murrill, Jour. Myc. **9:** 91. 1903

Daedalea unicolor (Bull.) Fr.

Rare in Florida but very common northward on dead wood of various deciduous trees. Studies made in Europe prove that the species is often parasitic.

51. DAEDALEA (Pers.) S. F. Gray

Context pallid; hymenium normally labyrinthiform but varying at times to lamellate or porose; spores hyaline.

Surface of pileus multizonate ..... 1. *D. confragosa*
Surface of pileus not zonate.
On hardwoods ..... 2. *D. ambigua*
On red cedar ..... 3. *D. Westii*

1. DAEDALEA CONFRAGOSA (Bolt.) Fr. Syst. Myc. **1:** 336. 1821

Common on dead wood of oak, sweet gum and other hardwood trees in

northern Florida, causing a white rot of the sapwood. This species has been separated from *Daedalea* and made the type of *Daedaleopsis* Schröt.

2. DAEDALEA AMBIGUA Berk. Lond. Jour. Bot. **4:** 305. 1845

Common on logs of oak, hickory, sweet gum and other hardwood trees in northern Florida and southward to Titusville, causing a white rot of sapwood. Compare *D. aesculi.*

3. DAEDALEA WESTII Murrill, Bull. Torr. Club **65:** 649. 1938

Rare on living trunks of southern red cedar near Gainesville and Cocoa; also found in South Carolina. It causes heart-rot.

ADDED SPECIES

Daedalea amanitoides Beauv. Fl. Oware **1:** 44. 1805. Described from Wari, Africa, and found on dead hardwood in tropical regions and southern Florida.

52. LENZITES Fr.

Surface zonate, tomentose; context white, flexible; hymenium lamellate; spores hyaline.

1. LENZITES BETULINA (L.) Fr. Epicr. Myc. 405. 1838

Common on dead wood of oak, sweet gum, hop hornbeam and other hardwood trees in northern Florida, causing a white rot of sapwood. Well-known in Europe and North America.

53. GLOEOPHYLLUM Karst.

Context tough, brown; hymenium normally lamelloid or daedaleoid; spores hyaline.

Surface hirsute.....1. *G. hirsutum*
Surface finely tomentose or glabrous.
Hymenium not lamelloid at first.....2. *G. Berkeleyi*
Hymenium lamelloid from the first.....3. *G. striatum*

1. GLOEOPHYLLUM HIRSUTUM (Schaeff.) Murrill, Jour. Myc. **9:** 94. 1903

Lenzites saepiaria (Wulf.) Fr.

Common on dead coniferous wood, and rarely on hardwood, in temperate regions, extending into tropical America. Very destructive to coniferous timber, causing a brown carbonizing saprot, and sometimes producing heart-rot in living trunks.

2. GLOEOPHYLLUM BERKELEYI (Sacc.) Murrill, Bull. Torr. Club **32:** 370. 1905

Daedalea Berkeleyi Sacc.

Described from Gainesville on pine stumps, and found frequently in

northern Florida on railway ties, structural timbers and other forms of pine wood.

3. GLOEOPHYLLUM STRIATUM (Sw.) Murrill, Bull. Torr. Club **32**: 370. 1905.

Lenzites striata (Sw.) Fr.

Frequent in Florida from Union and Levy Counties southward on dead wood of cypress, palmetto, orange, red cedar, etc. Very common in tropical America.

ADDED GENERA AND SPECIES

PORODISCULUS Murrill

Stipe attached to vertex of pileus; spores hyaline.

1. PORODISCULUS PENDULUS (Schw.) Murrill, N. Am. Fl. **9**: 47. 1907

Peziza pendula Schw. *Polyporus pocula* (Schw.) B. & C.

Found on dead branches of chestnut, oak, etc. in the eastern United States. A large collection was recently made near Gainesville on stems of sumac killed by a fire.

ISCHNODERMA Karst.

Sessile with light-brown context and hyaline spores.

1. ISCHNODERMA FULIGINOSUM (Scop.) Murrill, Bull. Torr. Club **31**: 606. 1904

Polyporus resinosus (Schrad.) Fr. *Polyporus benzoinus* (Wahl.) Fr.

Found on logs of basswood, spruce, etc. in Europe and eastern North America. Rare in Florida, where it was collected by Calkins.

EXCLUDED GENERA AND SPECIES

Fistulina and *Porothelium* have been assigned by me to other families. Most species of *Irpex* should really be placed in the Polyporaceae but some need study. Compare my *Irpiciporus*.

Gloeoporus and *Merulius* are more or less gelatinous, hence excluded in my classification. *Laschia*, *Favolaschia*, *Filoboletus*, etc. have been recently studied by Dr. Singer (Lloydia **8**: 170–230), who cites four species for Florida: *Filoboletus gracilis* (Kl.) Sing., *Favolaschia cinnabarina* (B. & C.) Pat., *Favolaschia sabalensis* (Charles) Sing. and *Dictyopanus pusillus* (Lév.) Sing. This last is our very common little fungus on dead sticks usually called *Favolus rhipidium*.

Pytohogaster cubensis Pat. is a queer, abnormal thing described from Cuba and found in Florida and Louisiana on decayed spots on living trunks of certain oaks, maples, and wax myrtle. See Mycol. **34**: 142–153. 1942. Experts call this the conidial stage of a species of *Polyporus*, but more study is needed before I can place it accurately in my classification.

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* New genera, species, etc. are indicated by italics.

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A Quarterly Journal of Biological Science

THEODOR JUST, *Editor*
JOHN H. HOSKINS, *Associate Editor*

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